AED strategies in the community

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Conflicts of interest

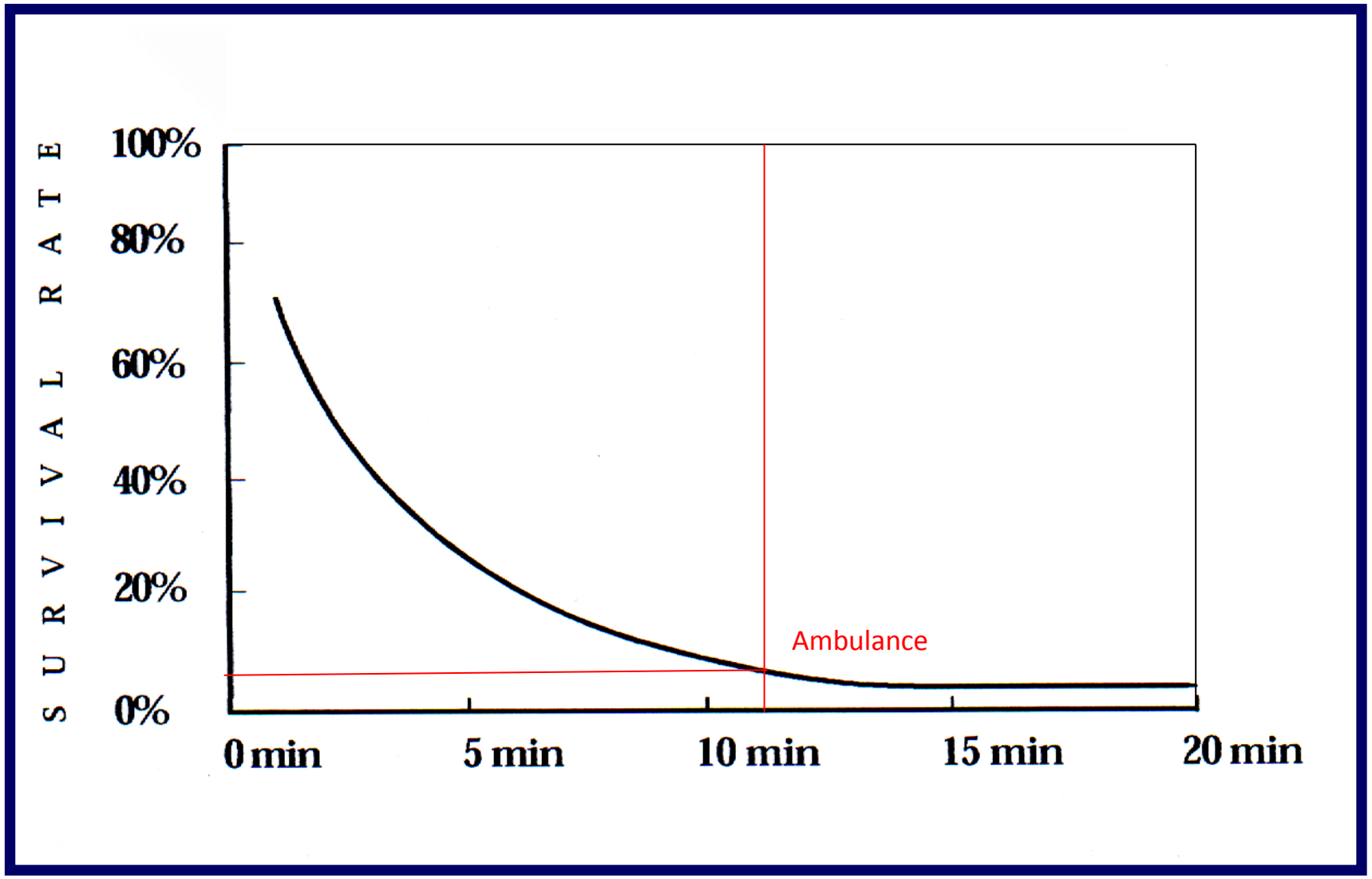
Arrest studies supported by

- Netherlands Heart Foundation
- Netherlands Ministry of Health
- Device companies
  - Physio Control
  - Zoll Medical
  - Cardiac Science
  - Defibtech

Why do we need AEDs?

Ambulances are fast….

.... but not fast enough



Weisfeldt NEJM 2011 Public vs. Home AED use 2

77% 23% 2% 16%

Variable	Bystander Witnessed Cardiac Arrest		Bystander Applied AED	
	Home (N=3451)	Public (N=1003)	Home (N=69)†	Public (N=159)‡
Mean age — yr	67.8±15.5	61.7±15.7	61.8±16.5	60.0±14.2
Male sex — no. (%)	2257 (65)	805 (80)	43 (62)	138 (87)
Bystander carried out CPR — no. (%)	1219 (35)	555 (55)	61 (88)	150 (94)
Bystander delivered AED shock — no. (%)	—	—	25 (36)	124 (78)
Initial VF or pulseless VT — no. (%)	1193 (35)	600 (60)	25 (36)	125 (79)
Time from 911 call to EMS arrival — min				
Median	5.6	5.0		
Interquartile range	4.3–7.1	3.8–6.6		
Survival to hospital discharge — no. (%)	276 (8)	202 (20)	8 (12)	54 (34)

Time to shock ± 7.6 ± 7 ?

?

AEDs only in public?

- In public:
  - Younger, more “healthy”, more witnessed arrest, more bystander CPR, more VF
- In the home:
  - Older, more comorbidity, less witnessed, less bystander CPR, later arrival of rescuers, less VF

BUT……..

- There are 3-4 times as many at home!

ARREST trategies in the community

Impact of Onsite or Dispatched Automated External Defibrillator Use on Survival After Out-of-Hospital Cardiac Arrest

Jocelyn Berdowski, PhD; Marieke T. Blom, MA; Abdennasser Bardai, MD; Hanno L. Tan, MD, PhD; Jan G.P. Tijssen, PhD; Rudolph W. Koster, MD, PhD

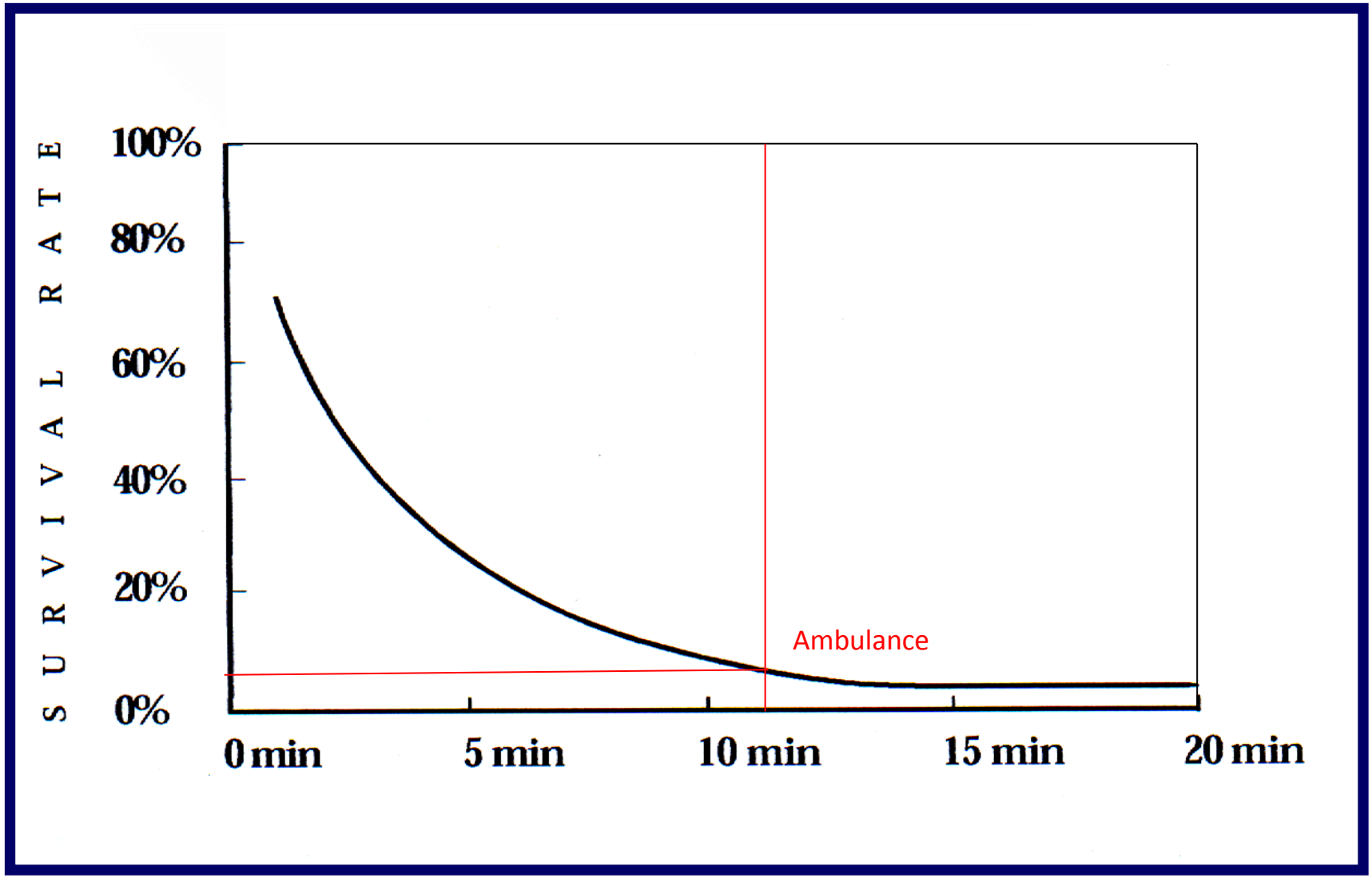
Circulation 2011;124:2225-2232

Survival by AED use in 2833 patients (all rhythms)

Period January 2006 to April 2009

Treatment with	Onsite AED	Dispatched AED	No AED
# of patients in group	N=128	N=478	N=2227
Call to arrival of ambulance (median, min)	9.0	9.2	8.9
Call to first shock (median, min)	4.1	8.5	11.0
% patients in VF (%)	76	50	47
Overall survival (all rhythms) %	49.6	17.2	14.3
AED use from all home	<<1%	18%	0%

Ambulances are not fast enough



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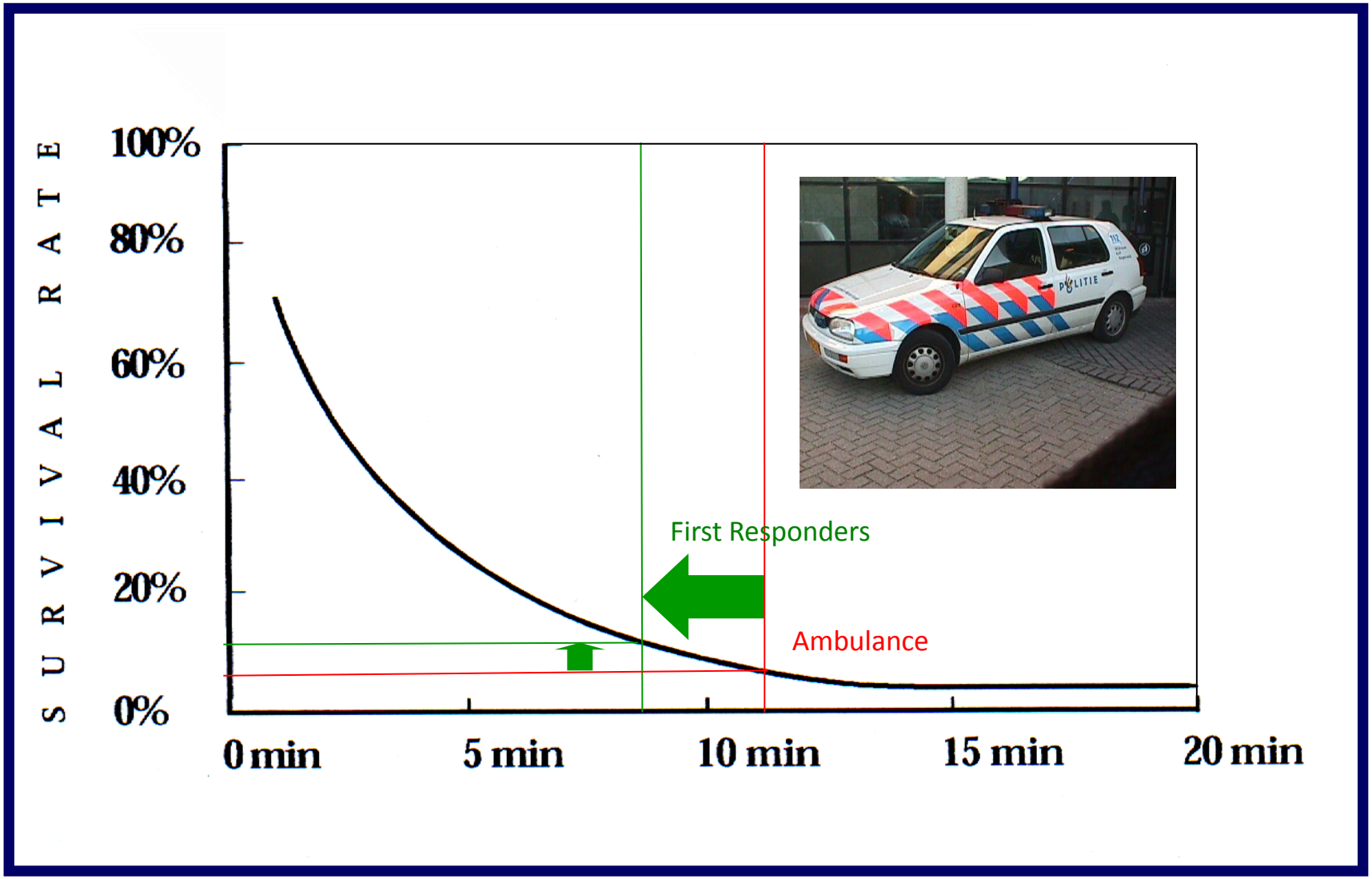
Who is the best first responder?



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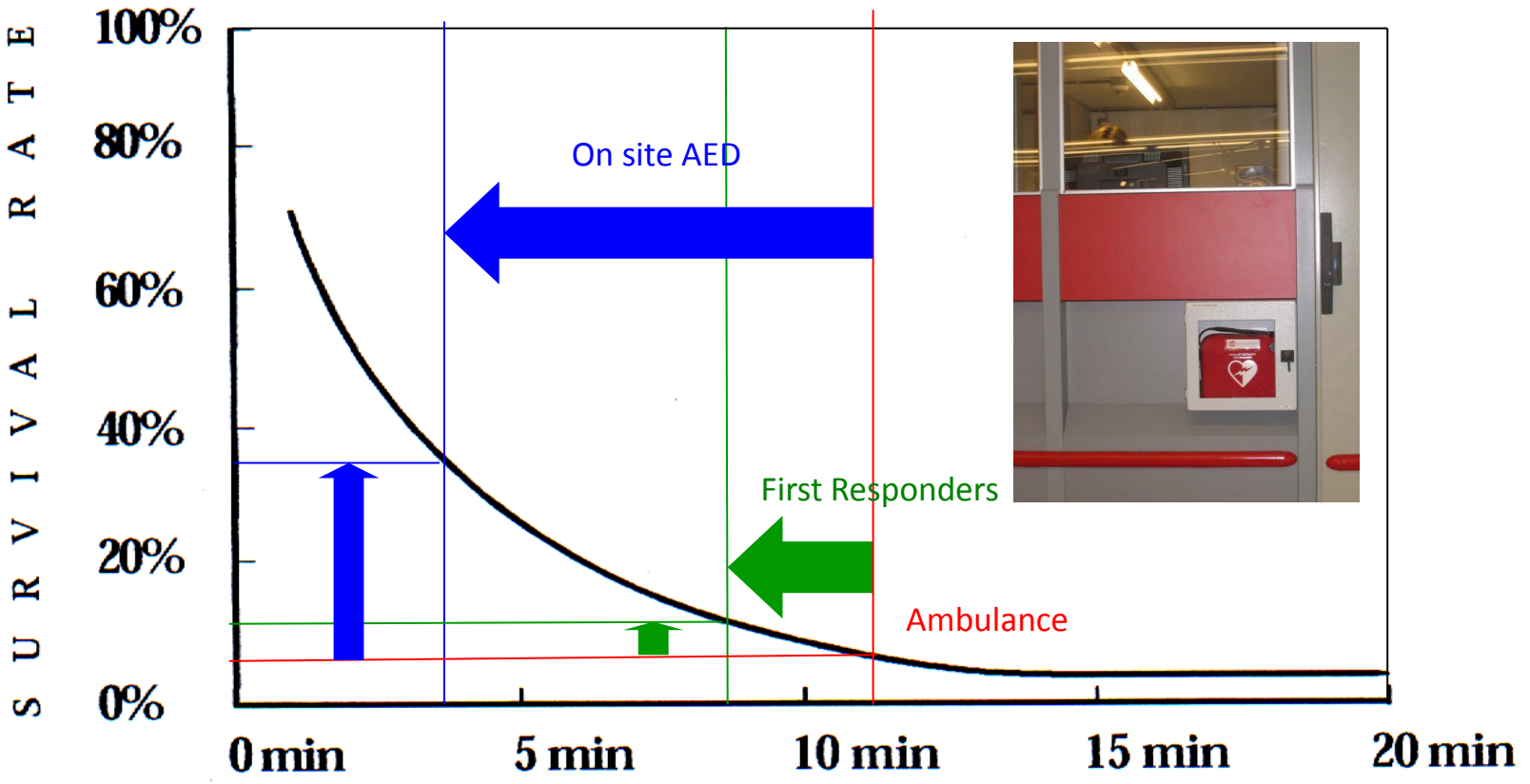
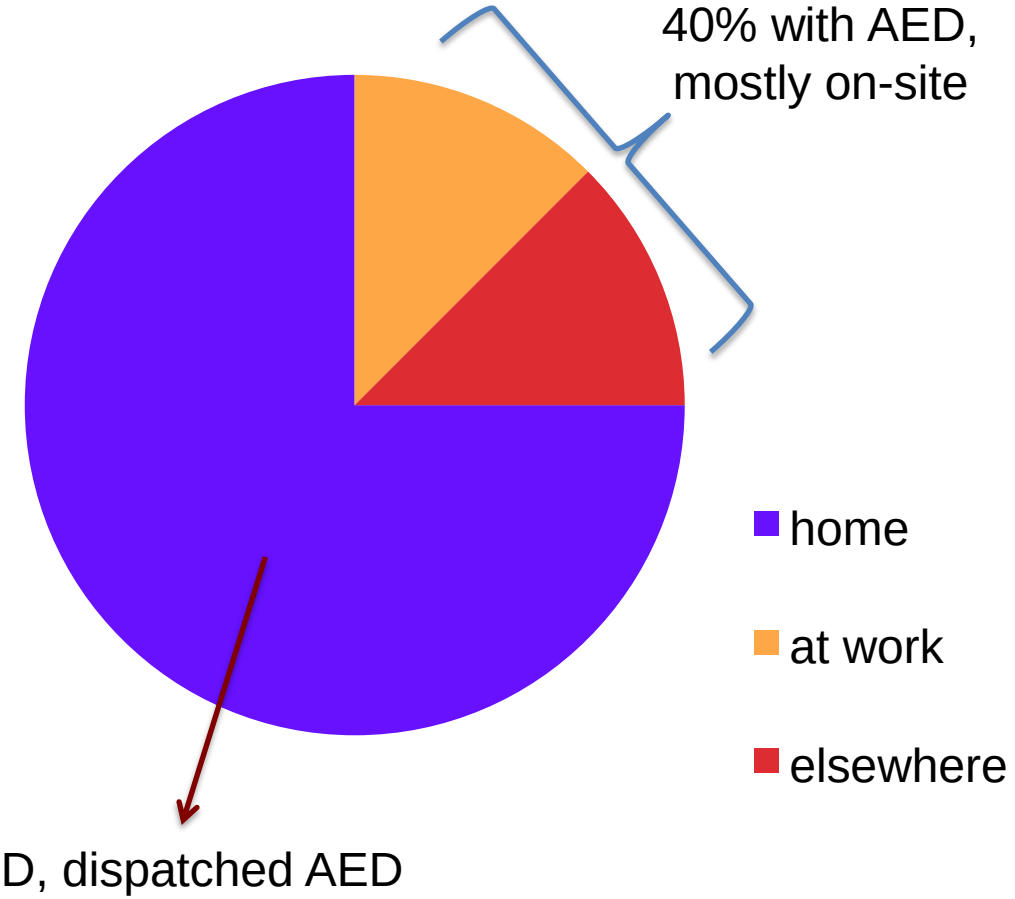
Public Access Defibrillation (PAD)



AED: public or residential use?

- Public use of AED is very effective: survival 49%
- Patients at home are seldom treated with AED: survival 17%
- More focus on residential AEDs!



What options can be considered for AED locations?

- Emergency Medical Services
- Dispatched by first responders (police, firefighters)
- AED at home
- Public Access Defibrillation
  - Schools
  - municipalities

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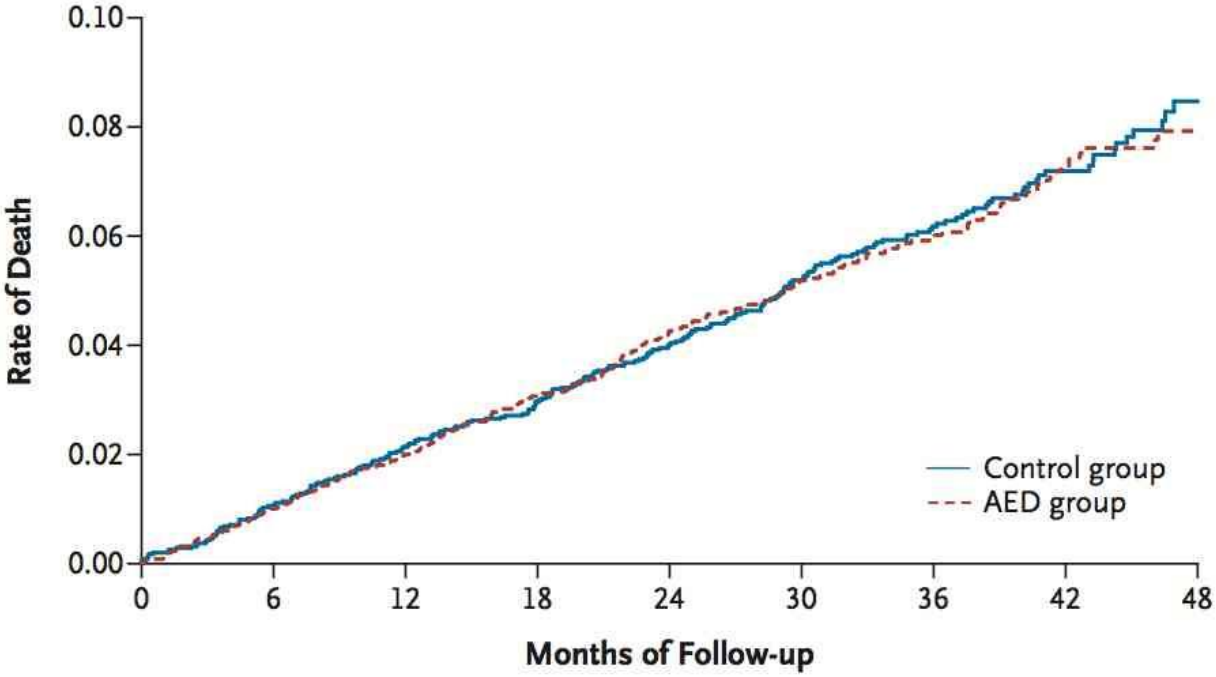
Home Use of Automated External Defibrillators for Sudden Cardiac Arrest

Gust H. Bardy, M.D., Kerry L. Lee, Ph.D., Daniel B. Mark, M.D., M.P.H.,

N Engl J Med 2008;358:1793-1804



No. at Risk									
Control group	3506	3469	3431	3402	3094	2453	1807	1115	359
AED group	3495	3460	3425	3388	3091	2476	1835	1130	376

Schools: 2 studies

USA: use of each AED once in 343 years

Japan: use of each AED once in 5826 years

1:5 000 000 years

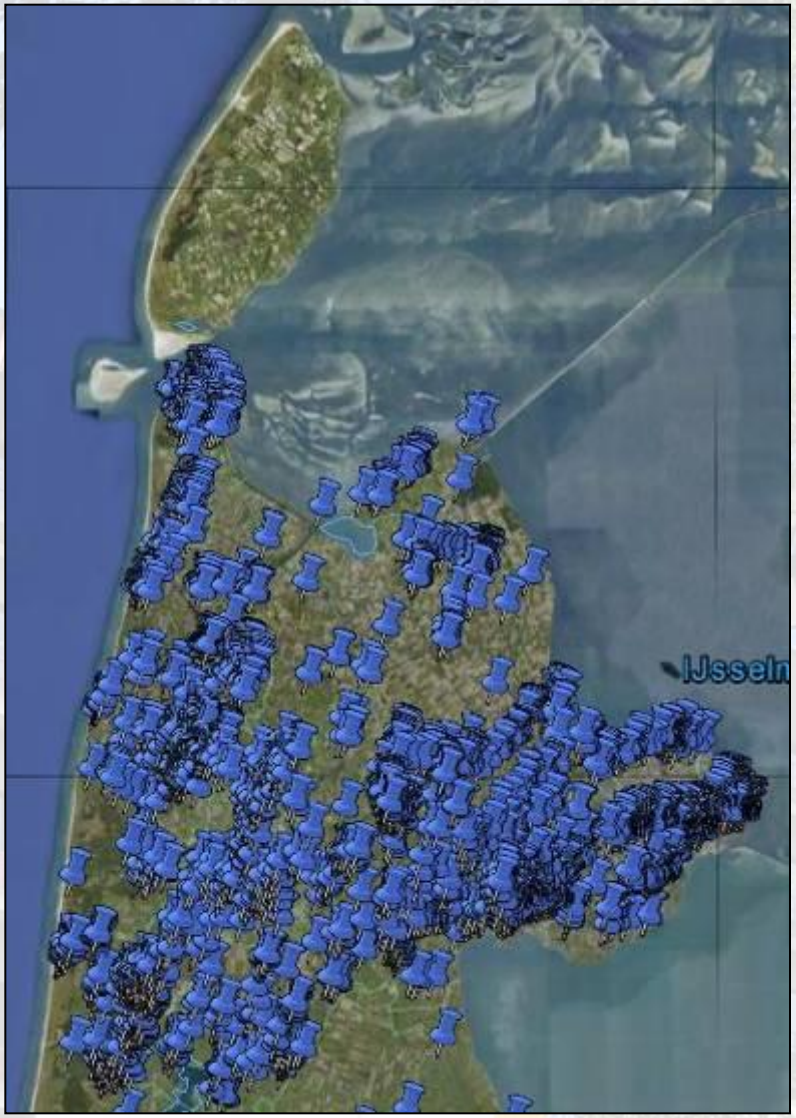
“The 6 minutes zone”

Target:
A region in which a first defibrillation is given <6 minutes after call in >25% of OHCA

Local rescuer activated by SMS from dispatch center

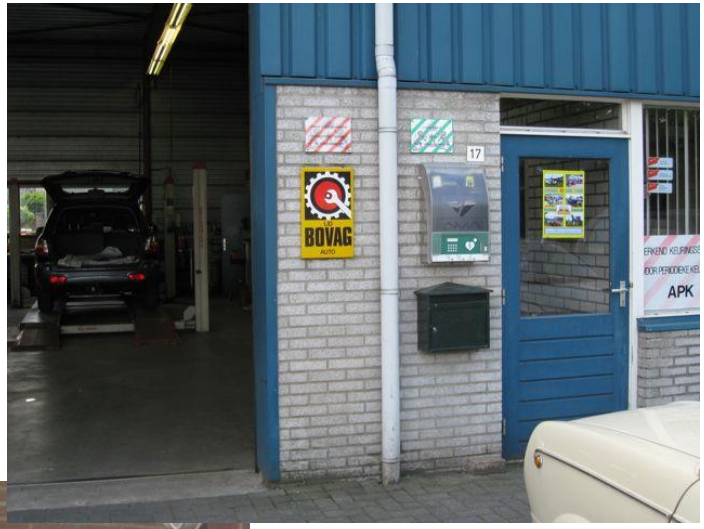
567 AED's

4503 civic lay rescuers

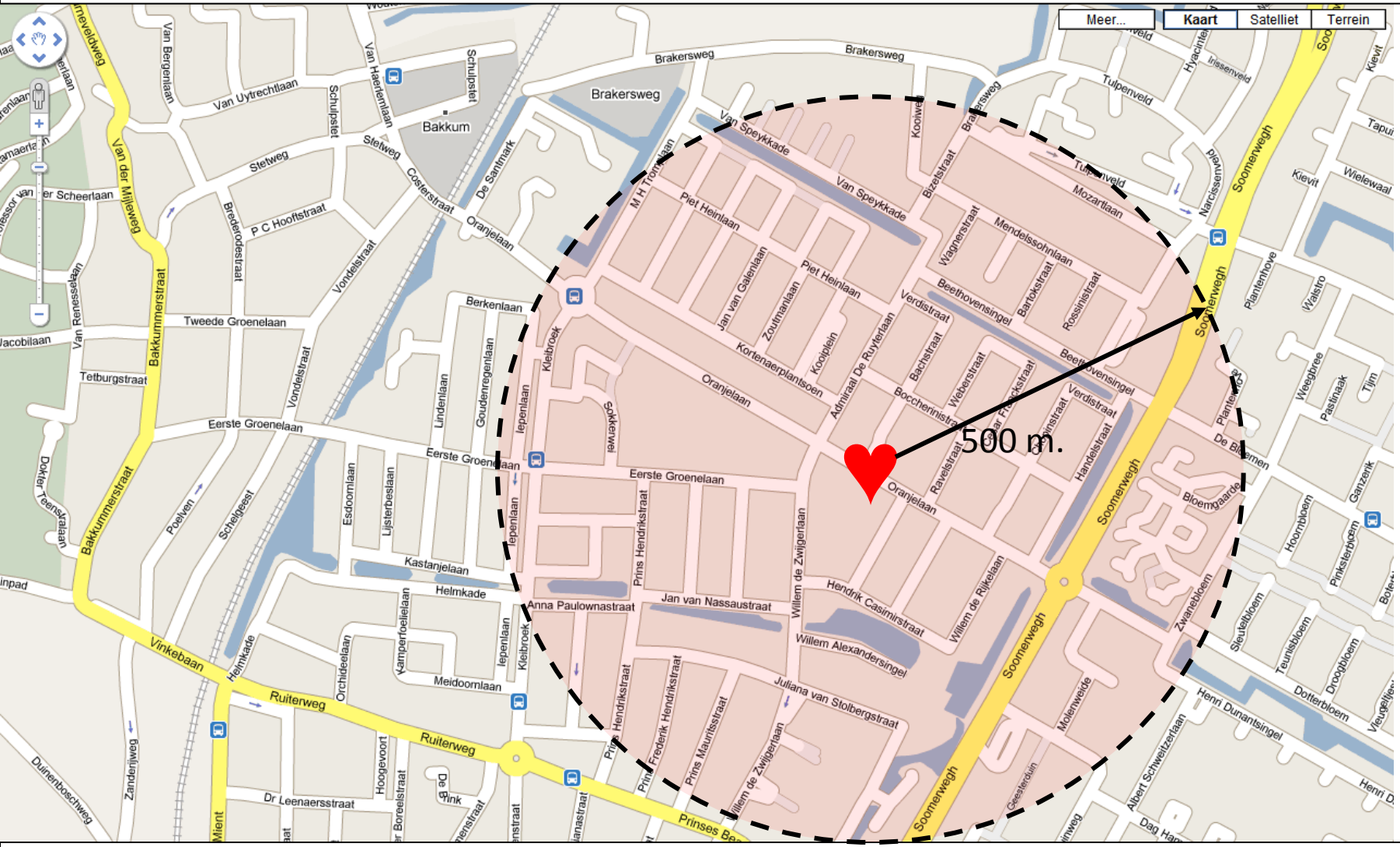


Communication with local rescuer: SMS message

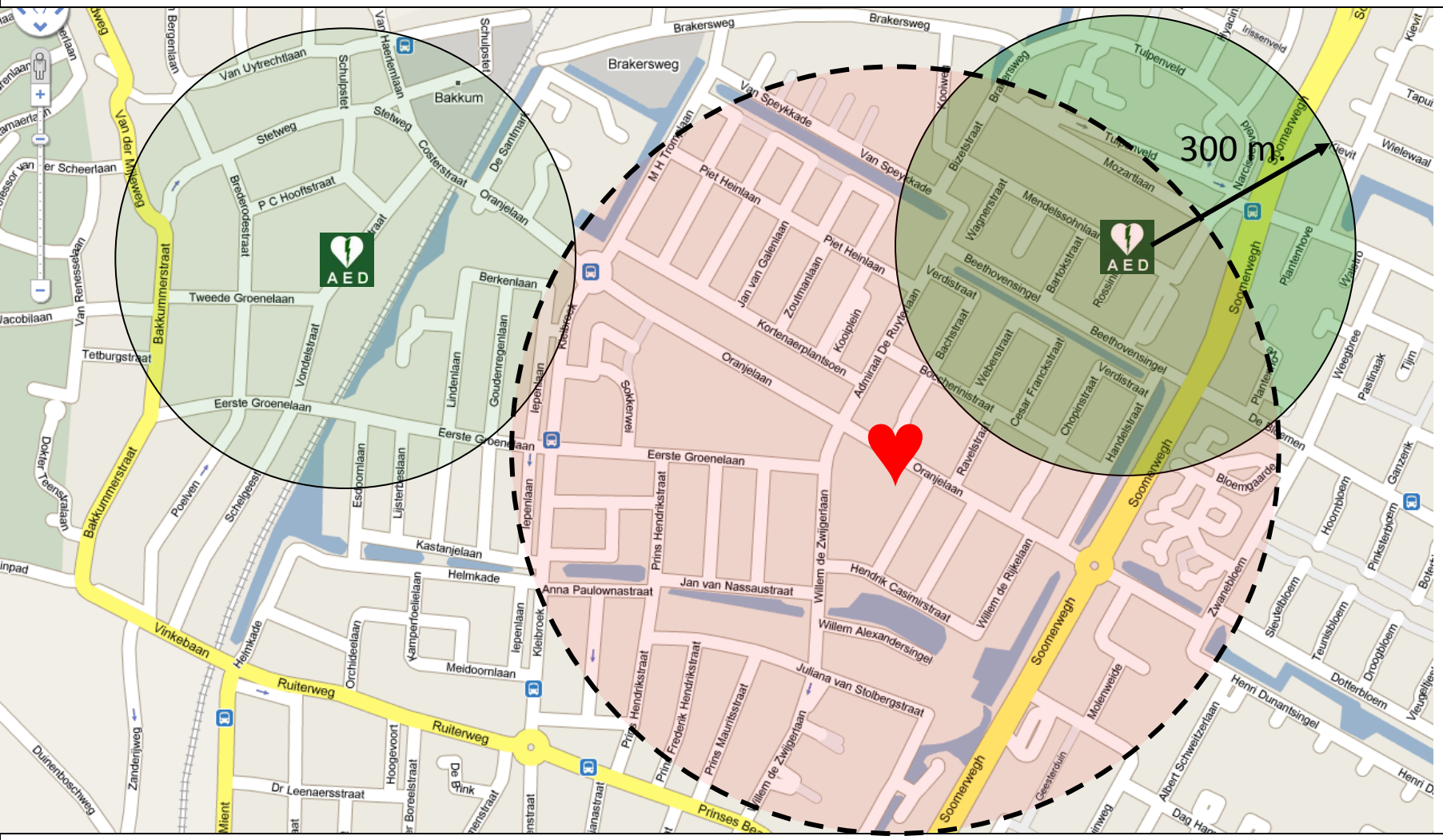
AEDs in residential areas



Simulation example: alarm system “AED-Alert”
1/5



Simulation example: alarm system “AED-Alert”
2/5



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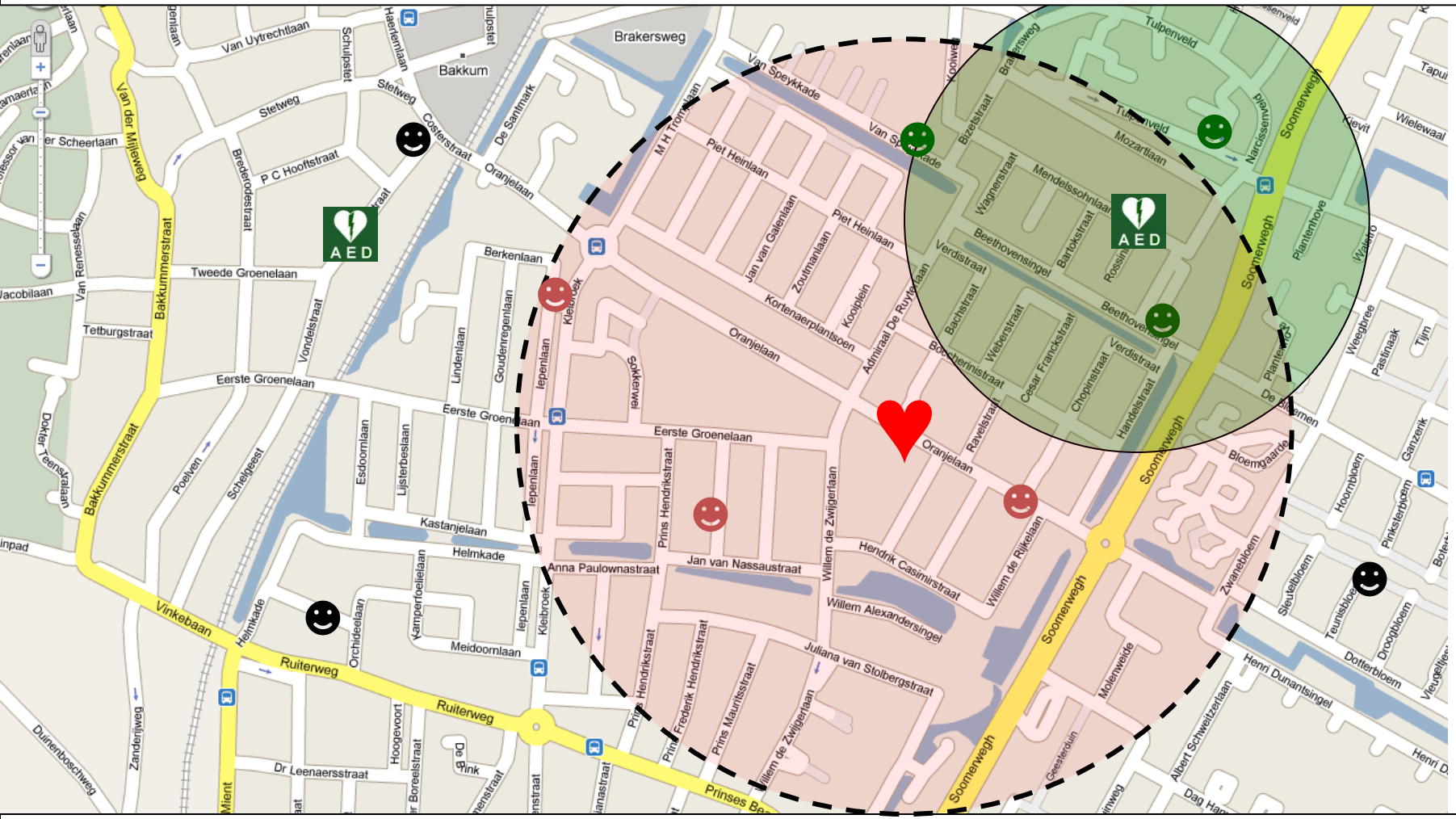
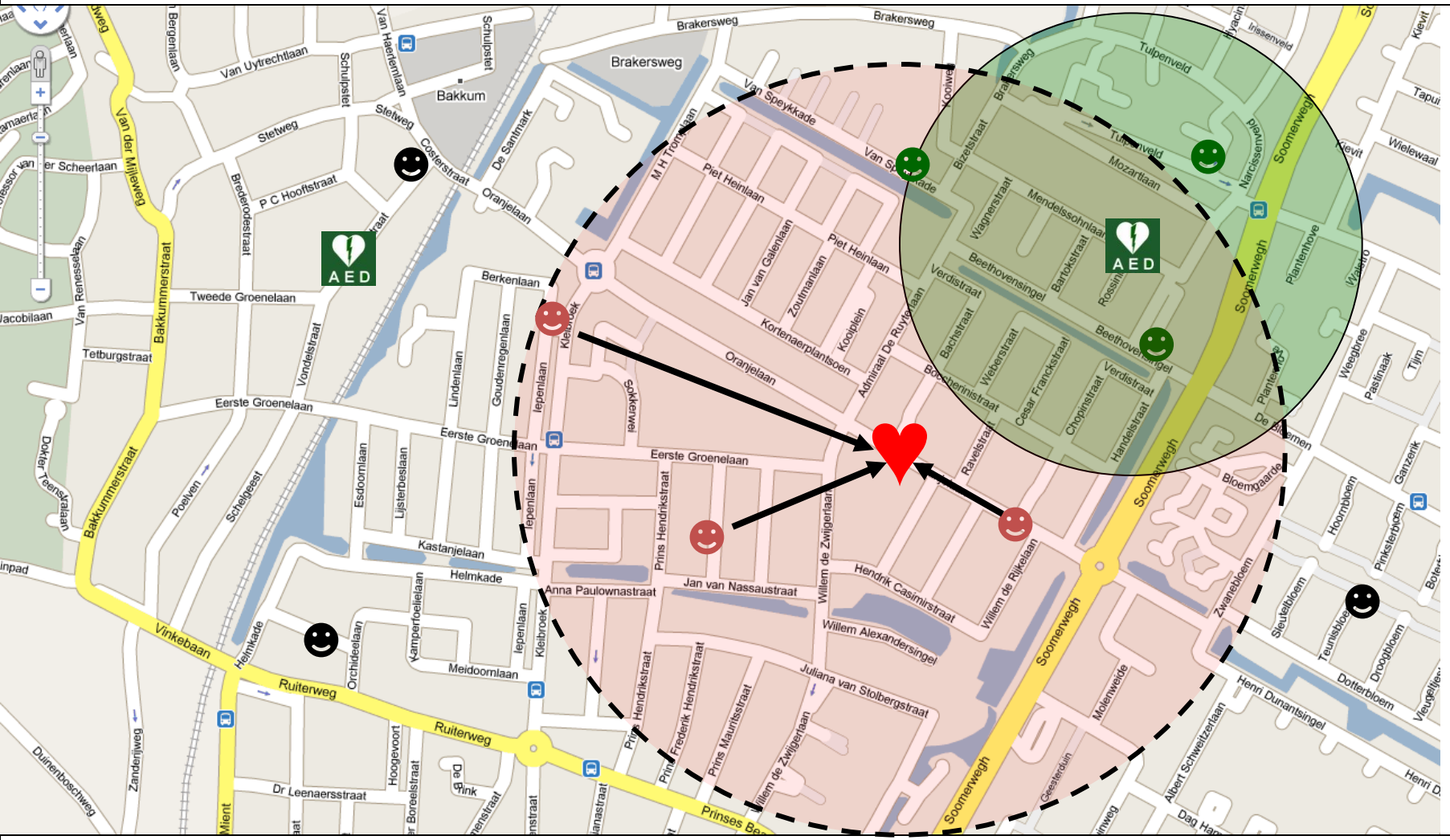
3/5



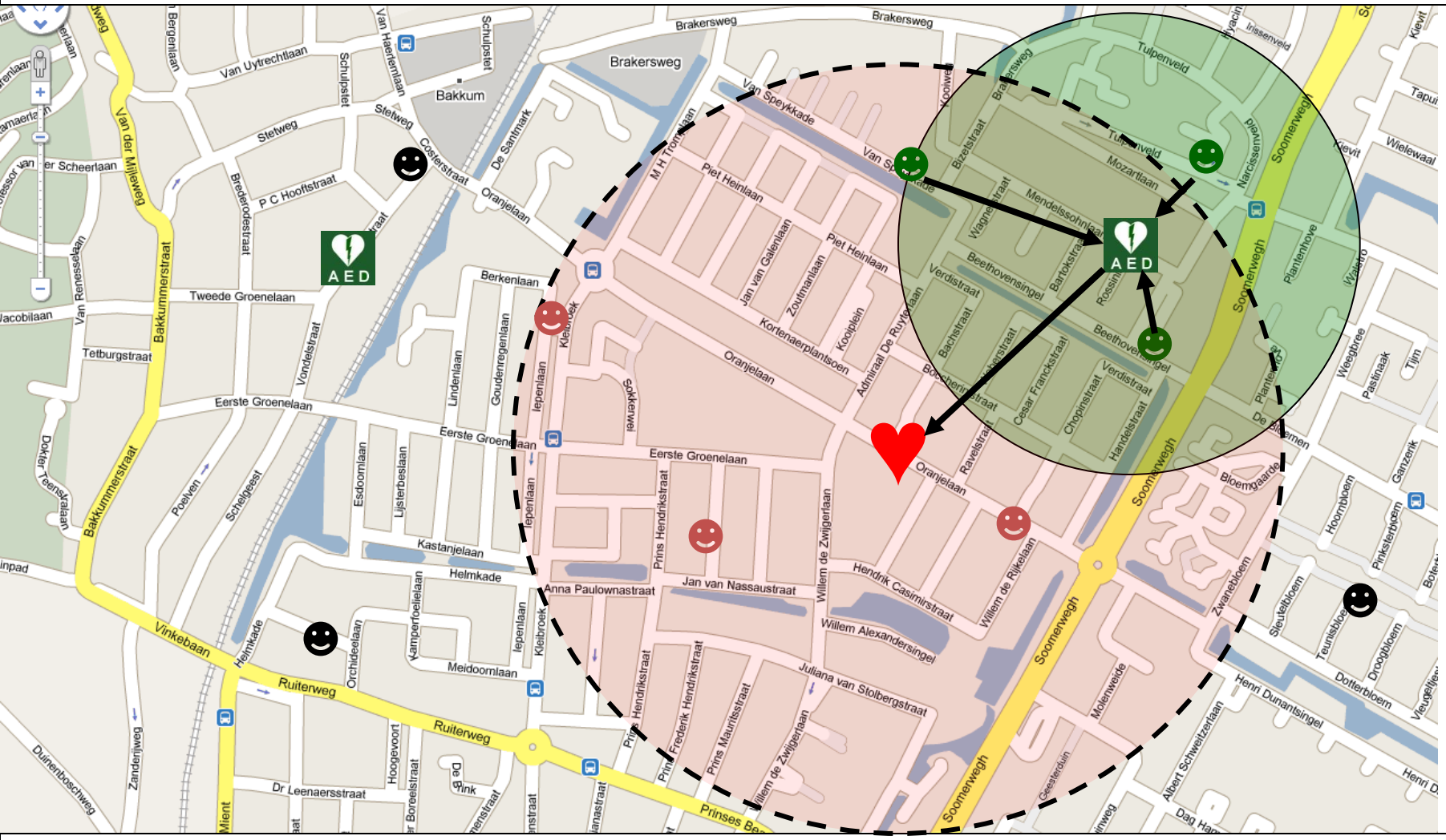
☻ Receives no sms.

Simulation example: alarm system “AED-Alert”
4/5



- Receives no sms
- SMS: “Go to Oranjelaan 10 and start CPR.”

Simulation example: alarm system “AED-Alert”
5/5



- “Go to Oranjelaan 10 and start CPR.”
- “Go to Rossinistraat 2, fetch the AED (Access # 2074). Then go to Oranjelaan 10”
- Receives no sms.

Smart smartphone

Arrest 16: volunteer rescuers with SMS messages

Start study
Juli 1, 2009

November 2012:

Inhabitants:
1.270.000

Rescuers:
12.295

AEDs:
1344

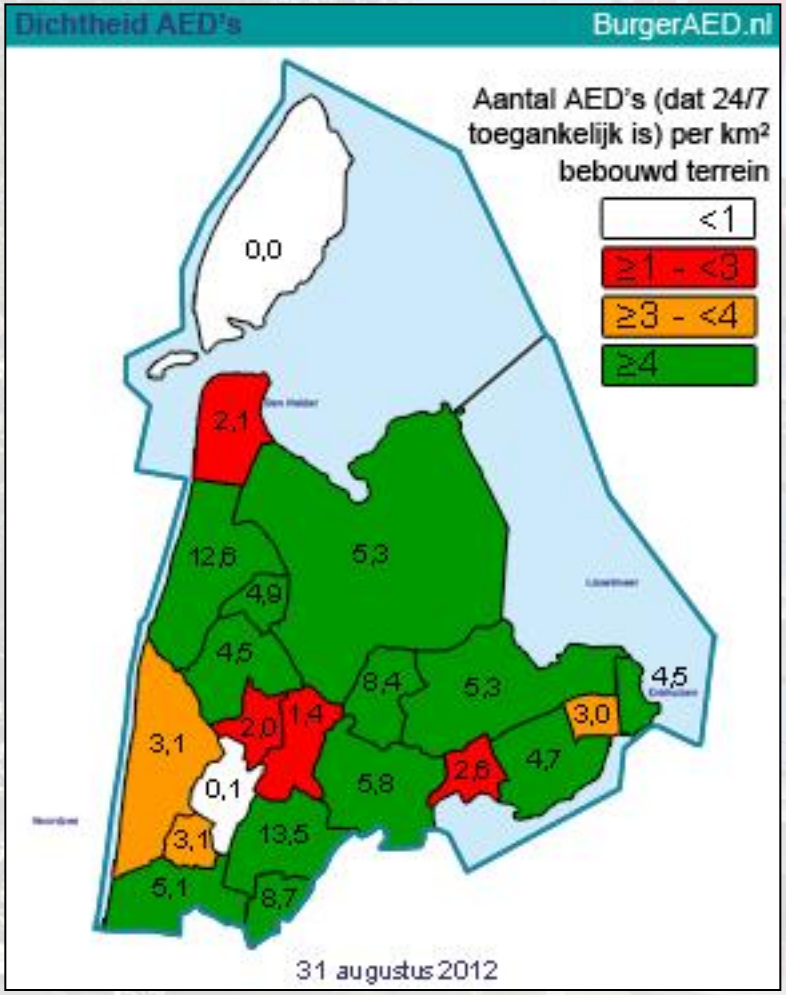
Questions

How many AEDs are needed?

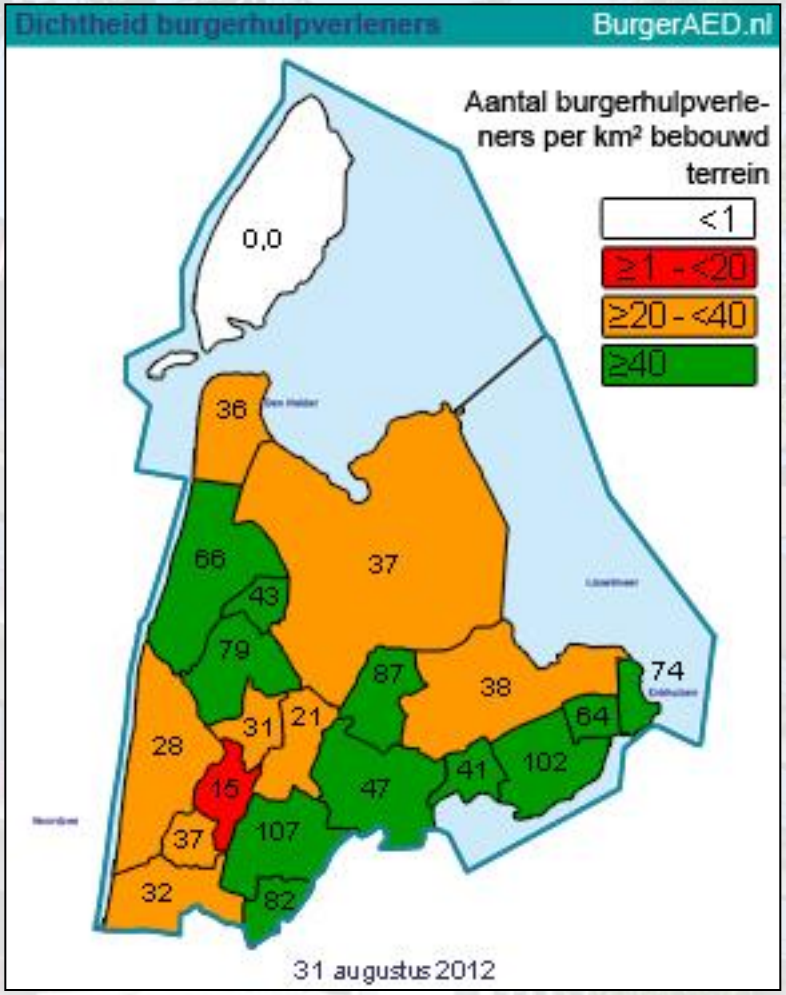
How many volunteer rescuers are needed?

Does it improve survival?

AED-density /km^2 populated



Density of civic lay rescuers

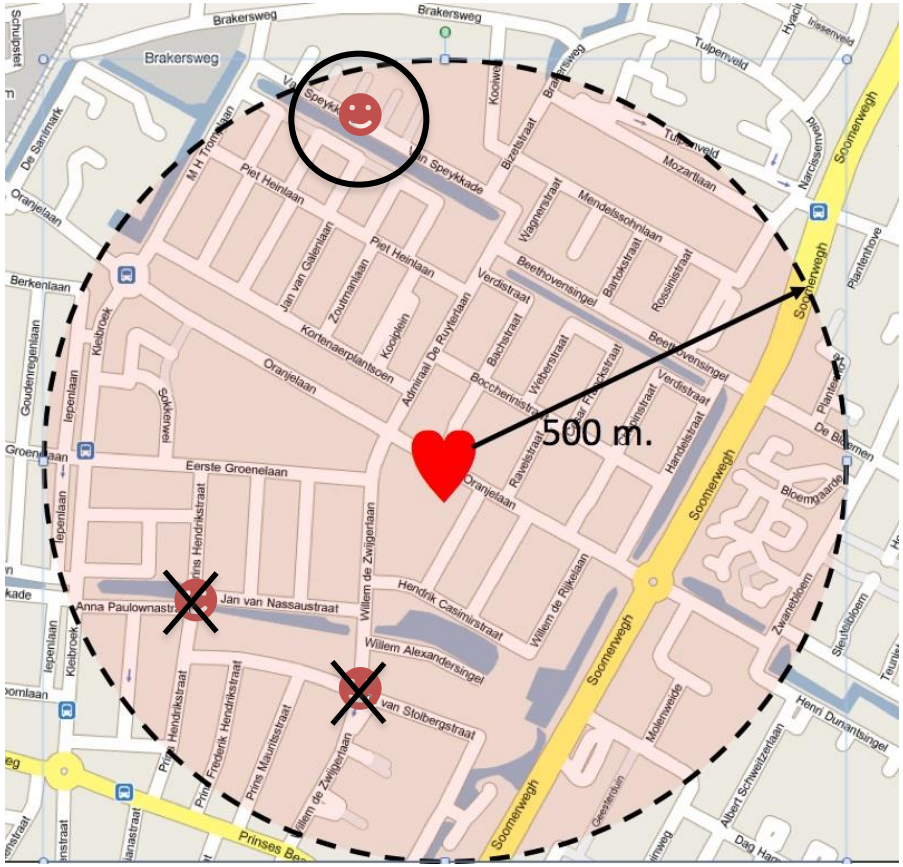


3 lay rescuers

15 lay rescuers

If 1 out of 3 is responding:

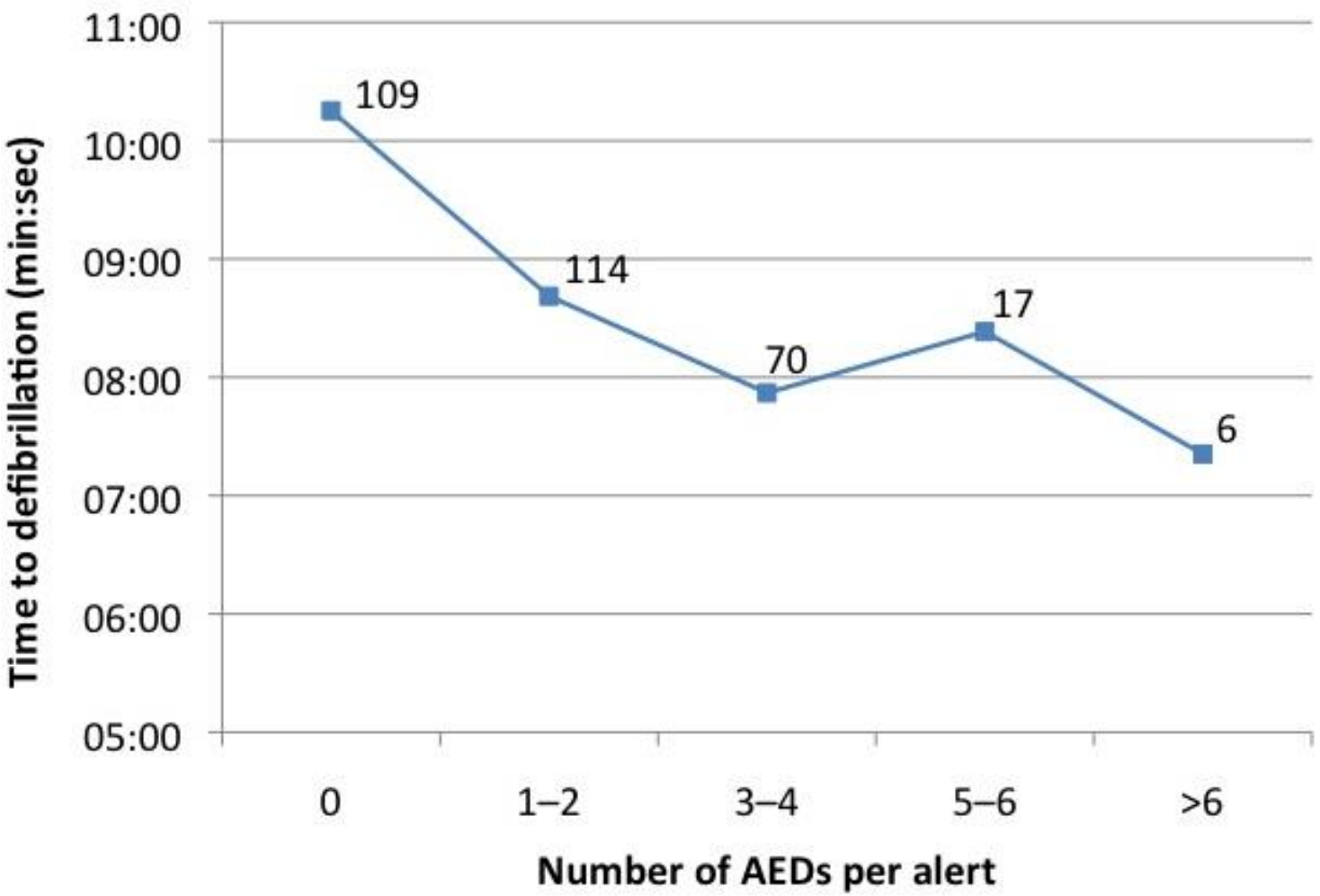
Of 3 lay rescuers 1 responds



Of 15 lay rescuers 5 respond

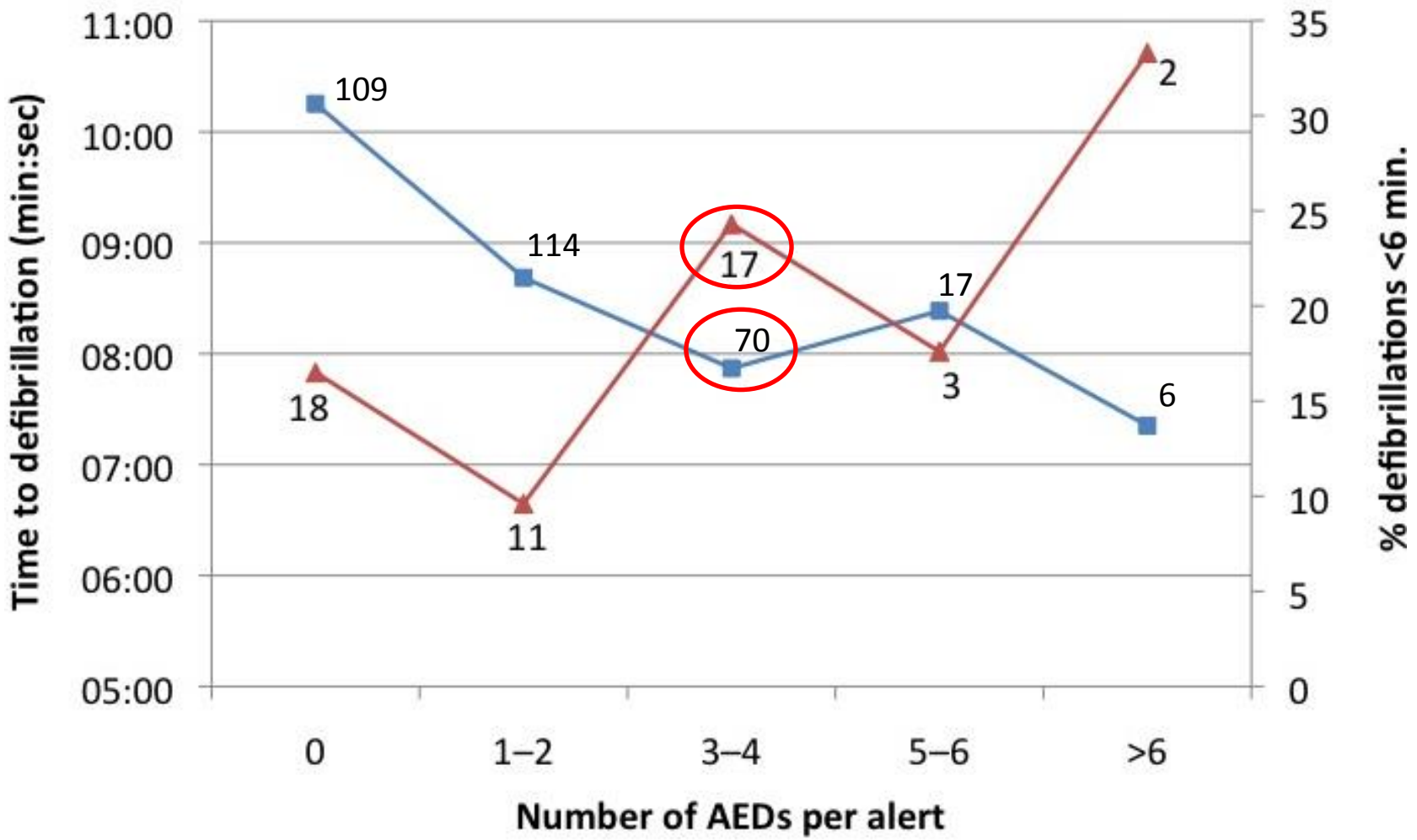
AED strategies in the community

Results – AEDs(1) – 31 months



AED strategies in the community

Results – AEDs(2) – 31 months



AED strategies in the community

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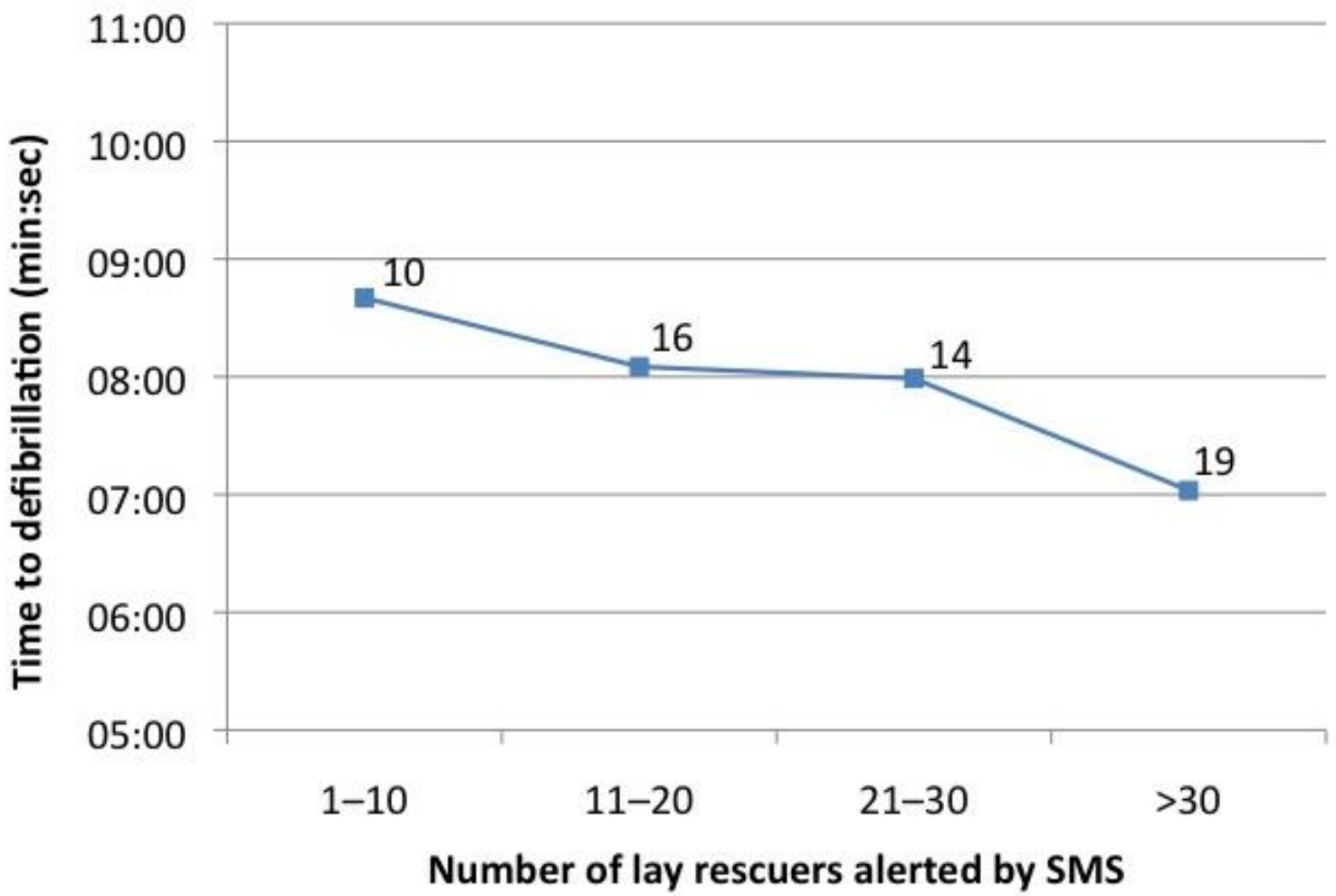
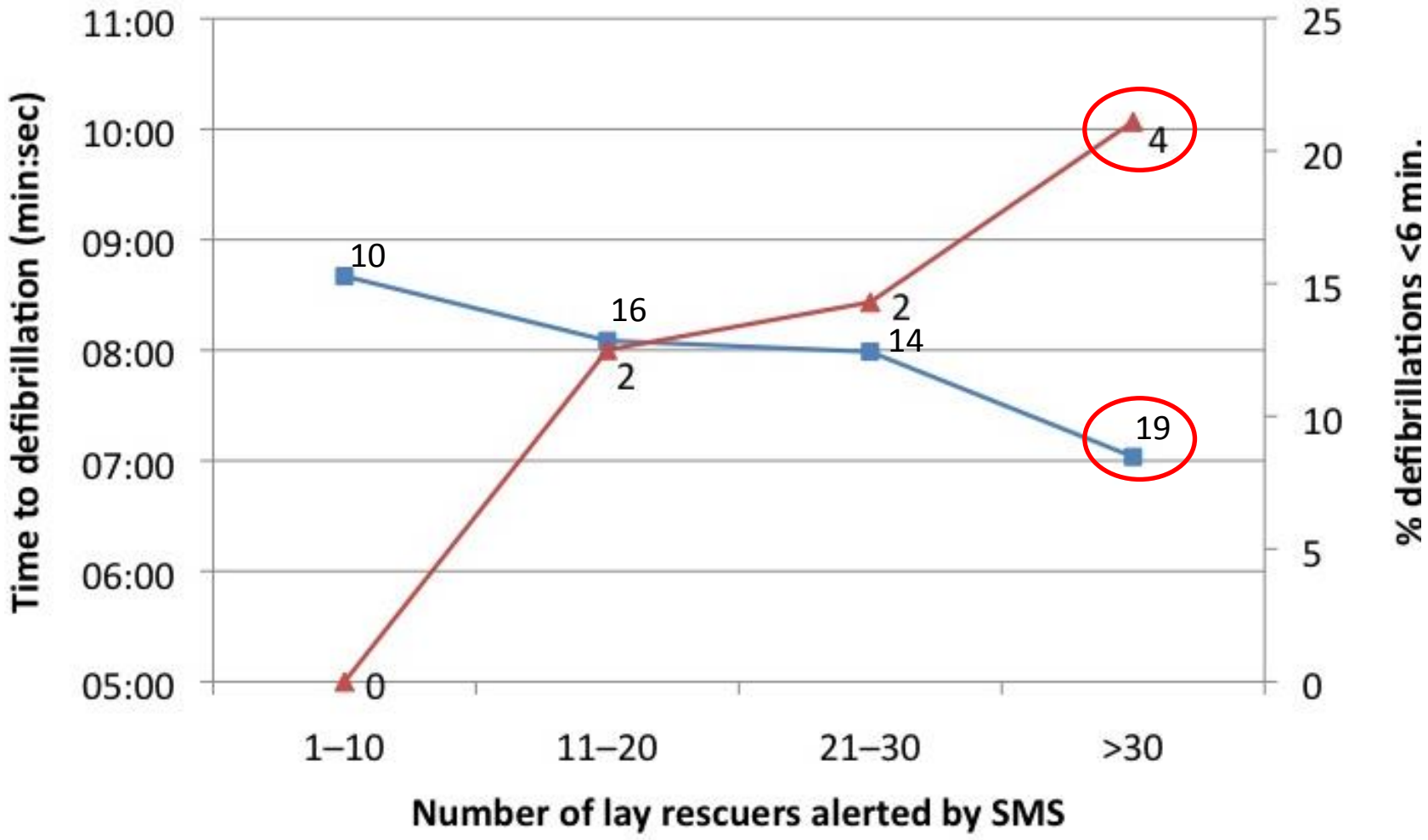


AED strategies in the community

Results – lay rescuers(2) – 31 months



Expect outcome data in 2014

Conclusion

- AEDs are needed to improve outcome
- Without AEDs survival will hardly improve
- AEDs in public increase survival dramatically, especially on-site
- Effectiveness in public dependent on numbers
- AEDs in residential areas underdeveloped

  are in need of better logistics

Collect and publish data!

Greetings from Holland

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AED


Chain of survival
Early recognition and call for help
- to prevent cardiac arrest
Early CPR
- to buy time
Early Defibrillation
- to restart the heart
Post resuscitation care
- to restore quality of life

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Circulation 2011;124:2225-2232

Table 1. Study Area and Number of Onsite and Dispatched Automated External Defibrillators

	AEDs	
	Present on Site	Available for Dispatch
Total AEDs, n	1583	67
Per 1 km^2	0.41	0.06
Per 1 km^2 inhabited area*	1.17	0.10
Per 100 000 population	65.25	5.06
Patients treated by AED per year, n	0.03	2.20

Lay rescuers with AED

- Alert via SMS message is feasible
- Faster response than ambulance
- Helps reduce time to defibrillation

- Next step: proof of increased survival

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Identifying Locations for Public Access Defibrillators Using Mathematical Optimization

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(*Circulation.* 2013;127:1801-1809.)

Area	Total No. of CAs	Total No. of AEDs	Total No. of CAs Covered	Coverage, %
Downtown	266	303	130	49
Outside downtown	1044	1366	174	17
Overall	1310	1669	304	23

AED indicates automated external defibrillator; and CA, cardiac arrest.
*Plus-minus values are mean±SD.

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Call to arrival of ambulance (median, min)	9.0	9.2	8.9
Call to first shock (median, min)	4.1	8.5	11.0
Survival %	49.6	17.2	14.3
AED use at home, from all AEDs	9%	71%	n/a
AED use from all home	<<1%	18%	0%

Arrest infrastructure 7/2005 - .....

Arrest studies: out of hospital cardiac arrest

Start 1995

July 2011:

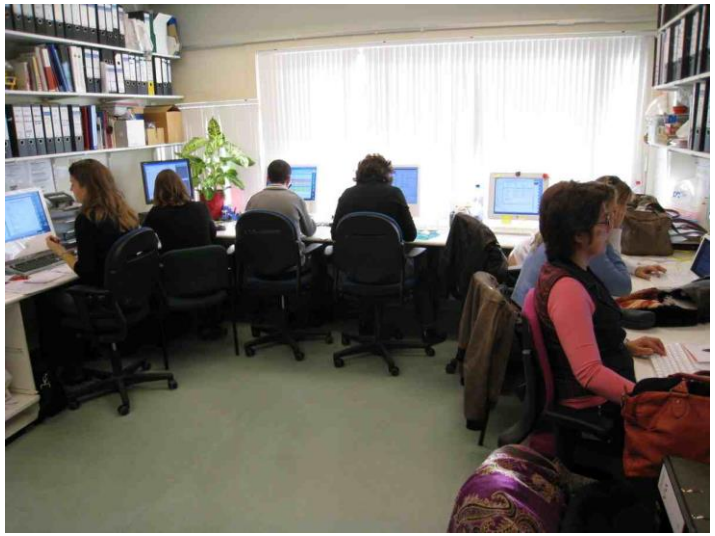
Inhabitants:
986.000

Rescuers:
10.200

AEDs:
1070

Arrest 7: infrastructure

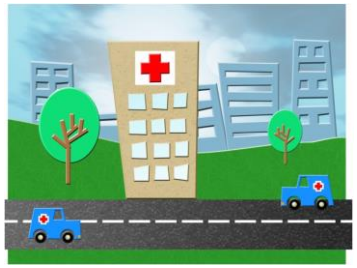
Dispatch center



Datacenter in AMC

Info from ambulance-personnel

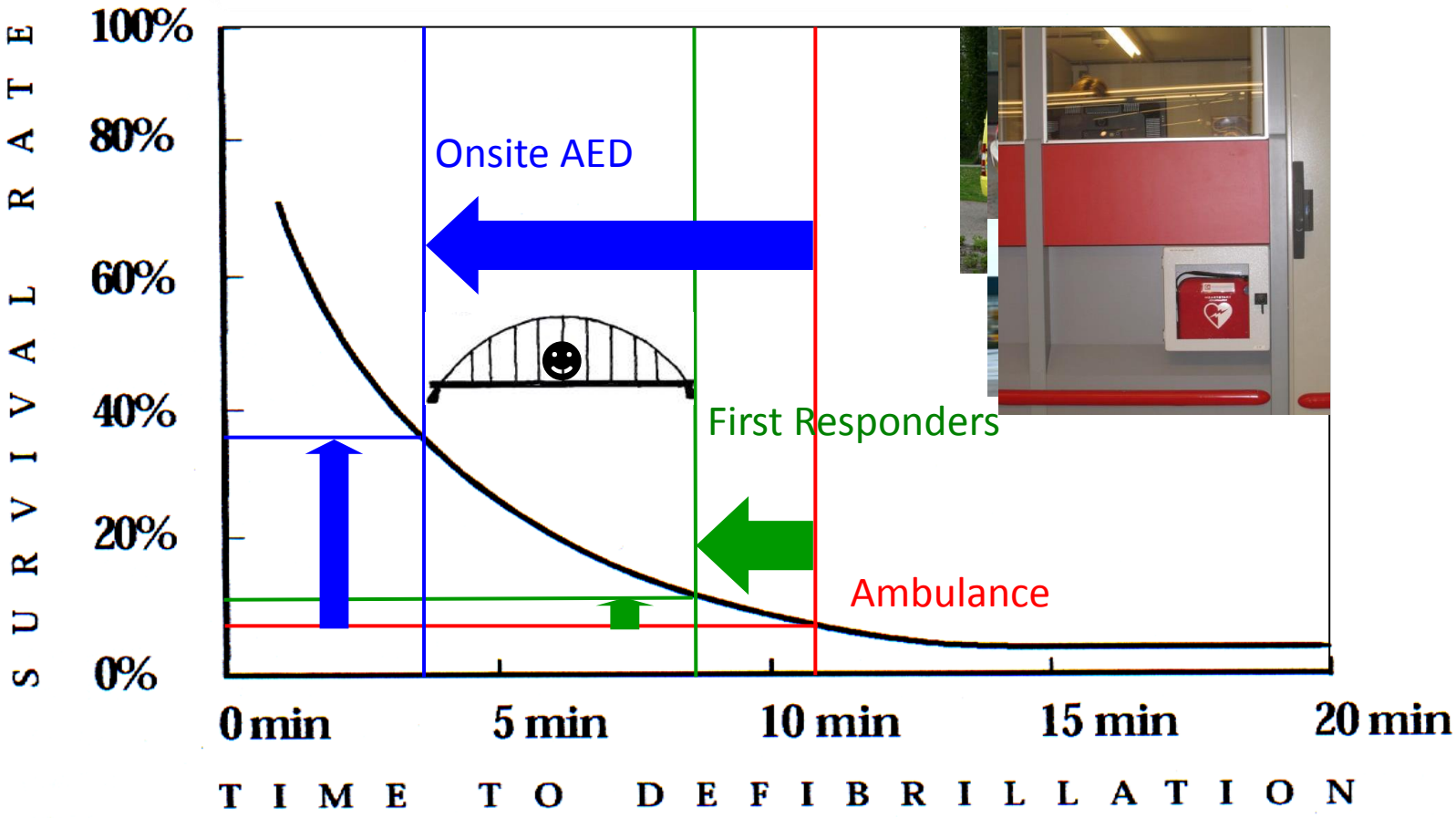
Data from AED



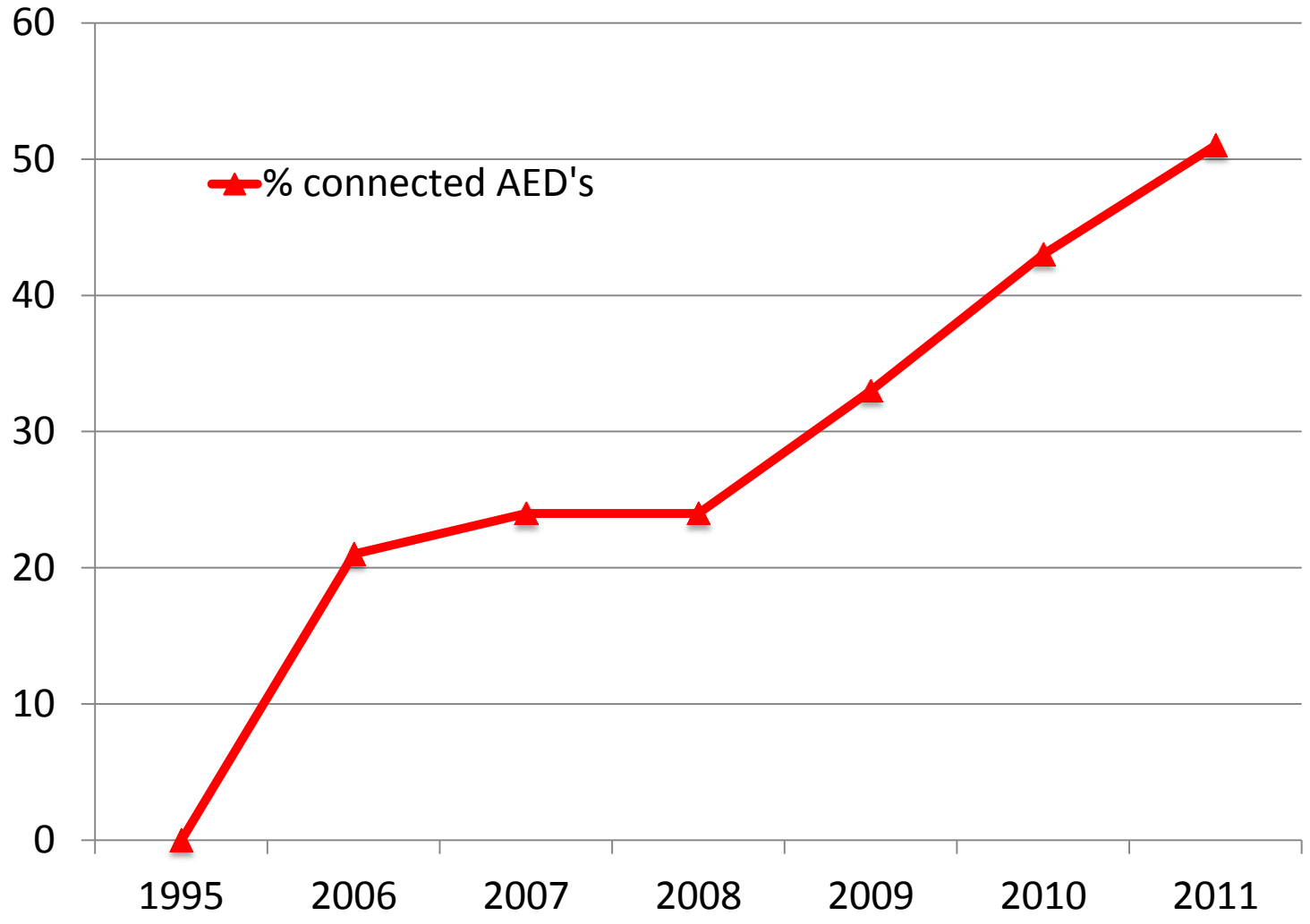
Data from hospital admission

Data transmission from ambulance defibrillator

Where is the best place for an AED?



Arrest studies 1995-2011
AEDs, shocks and survival



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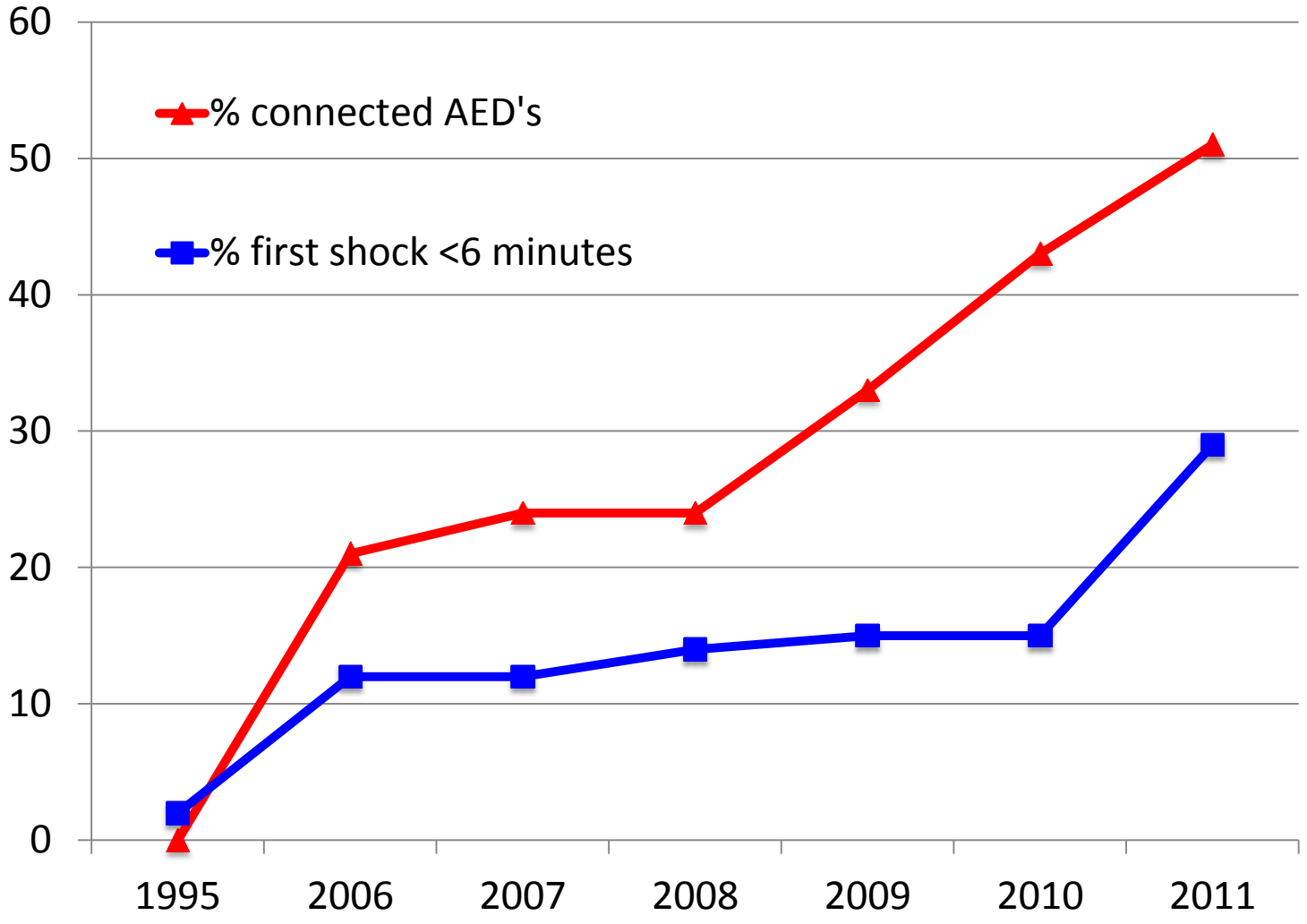

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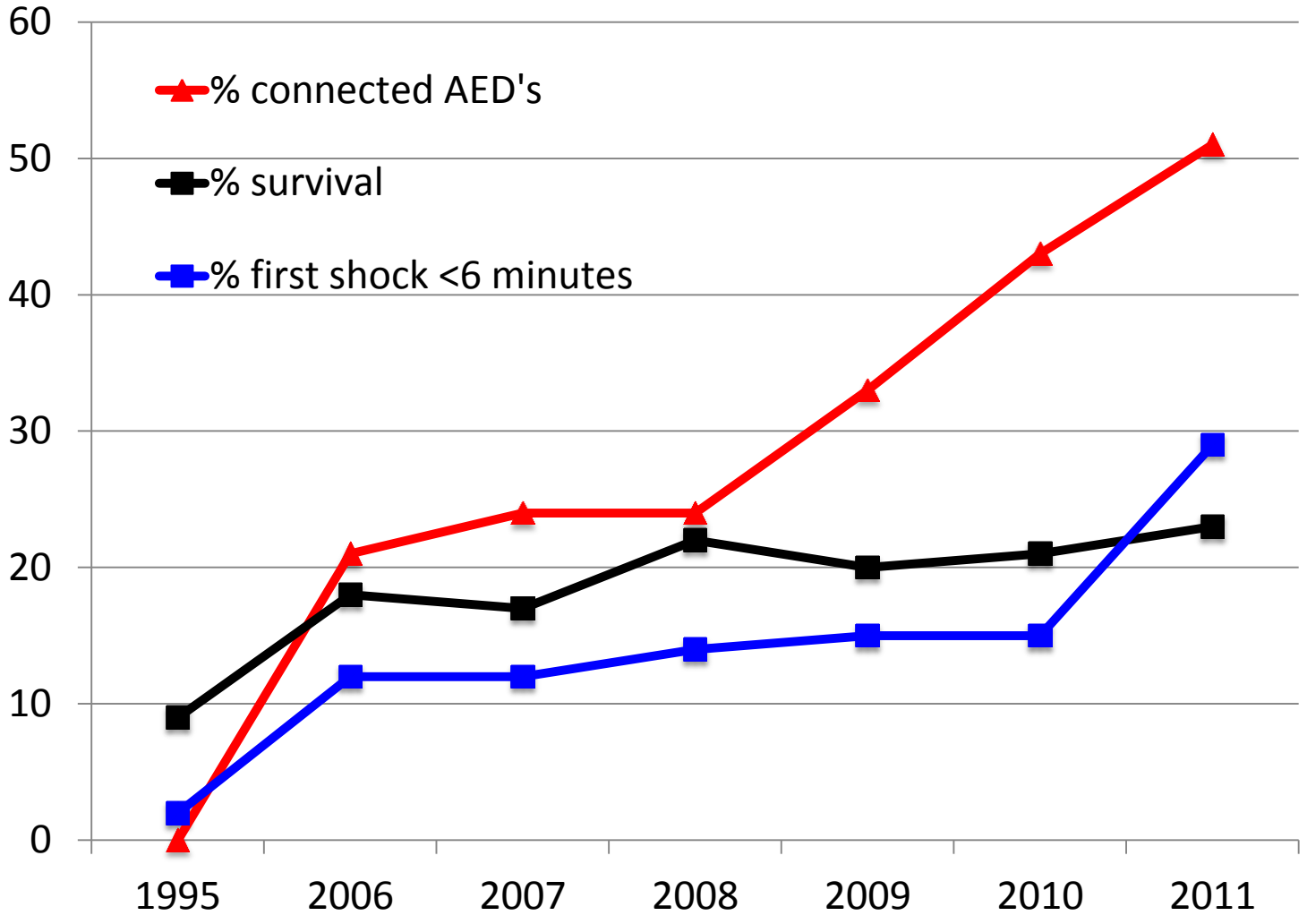
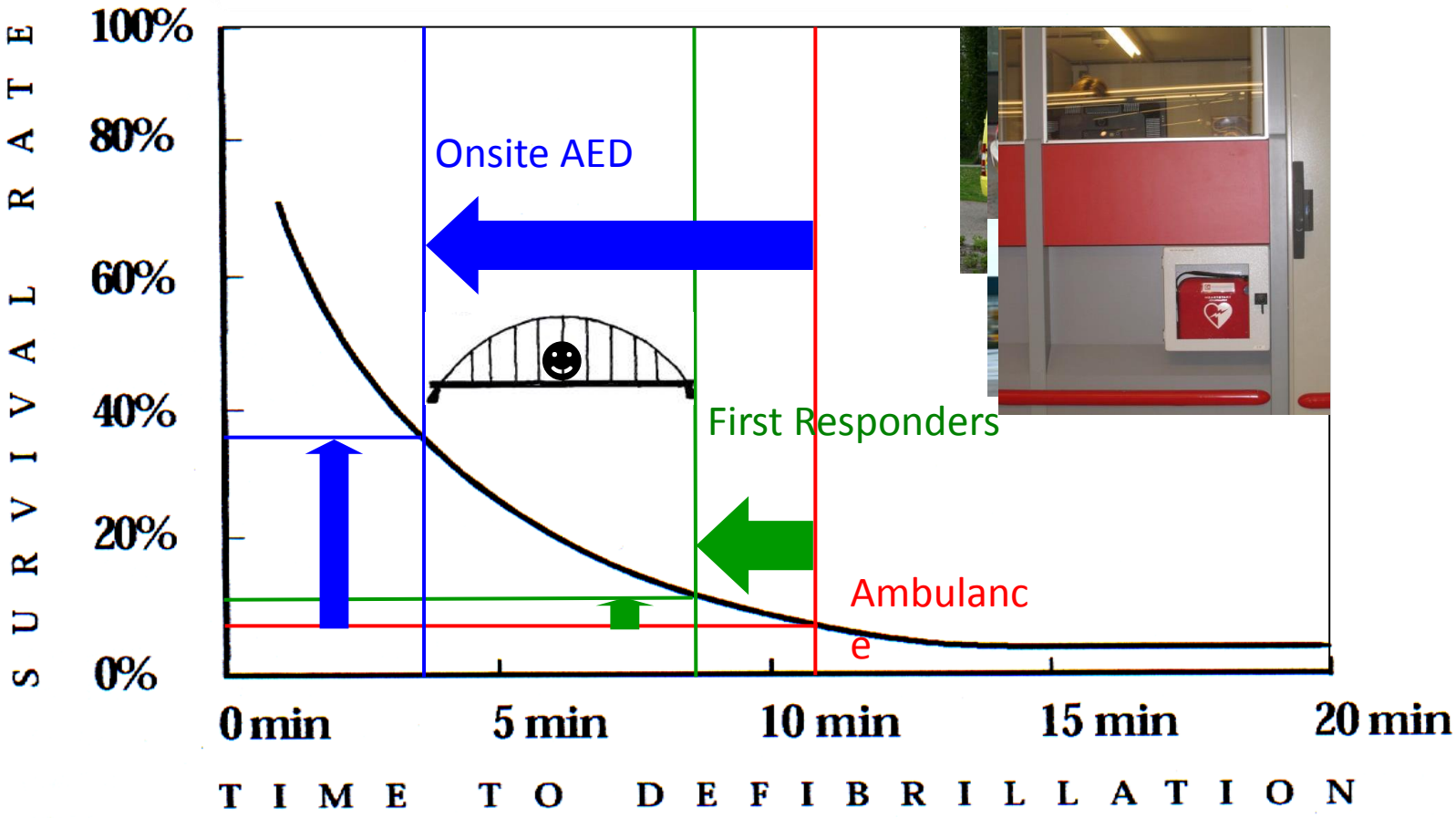
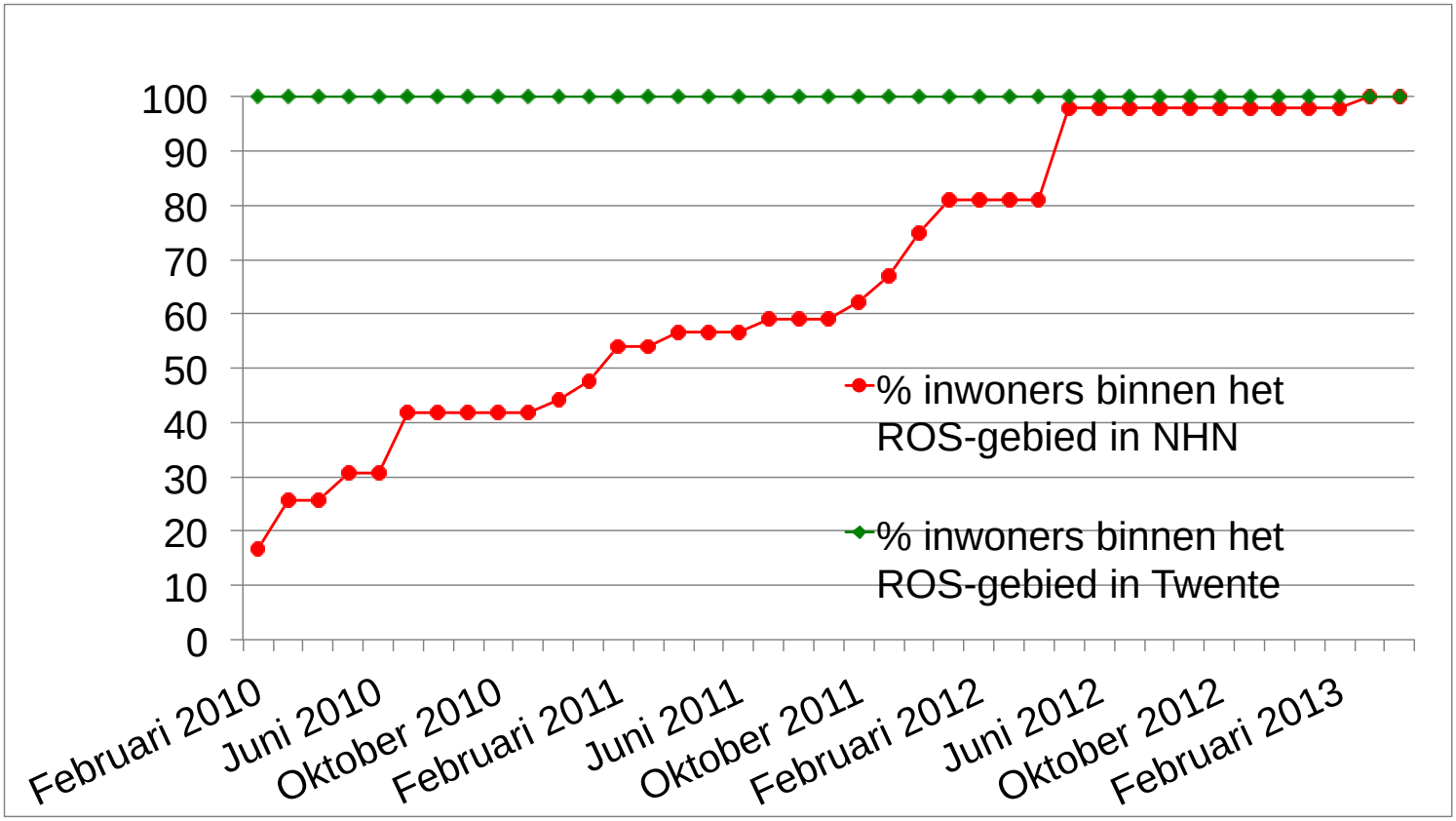


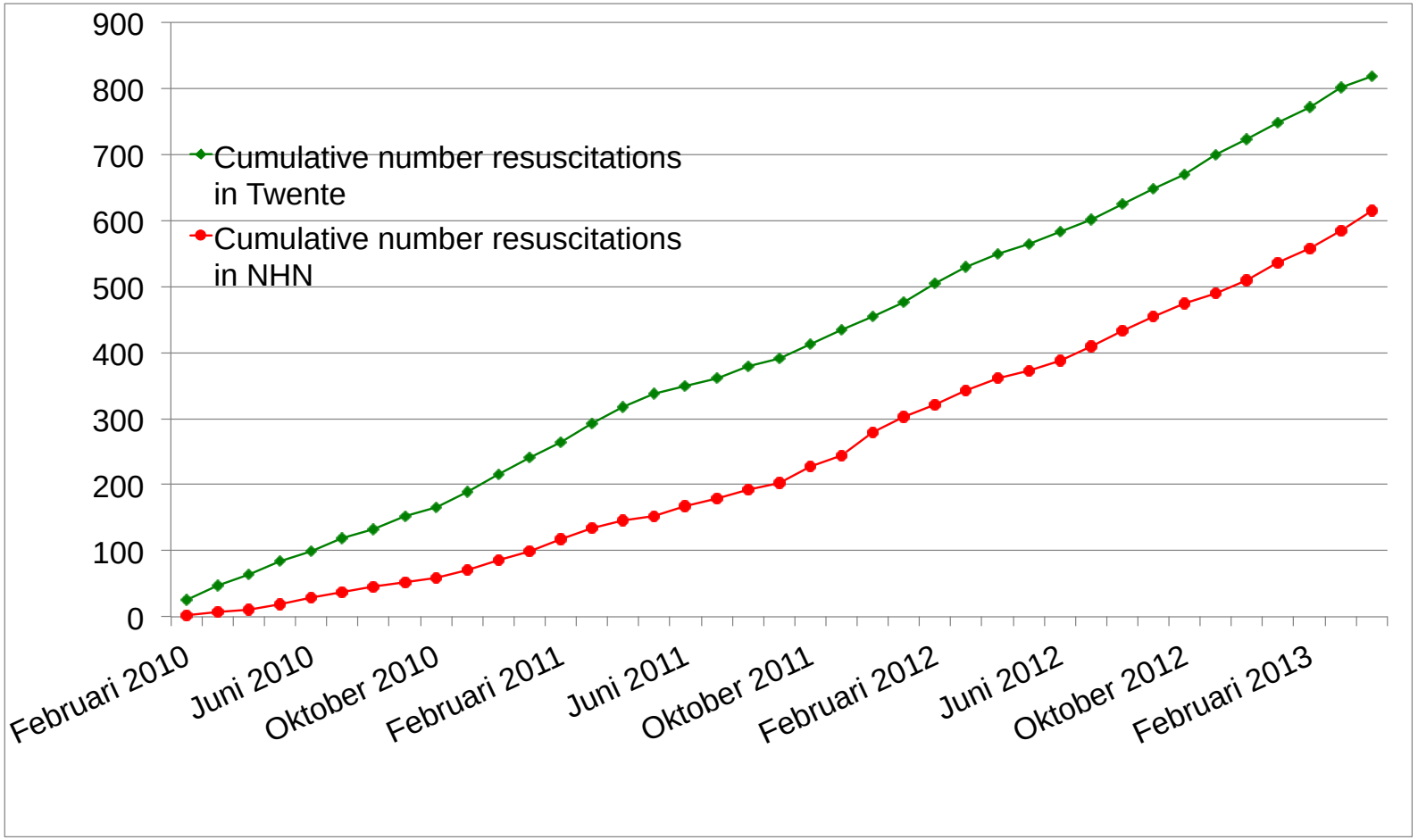
Background


SURVIVAL RATE
100%
80%
60%
40%
20%
0%
Onsite AED
First Responders
Ambulanc
e
0 min
5 min
10 min
15 min
20 min
TIME TO DEFIBRILLATION

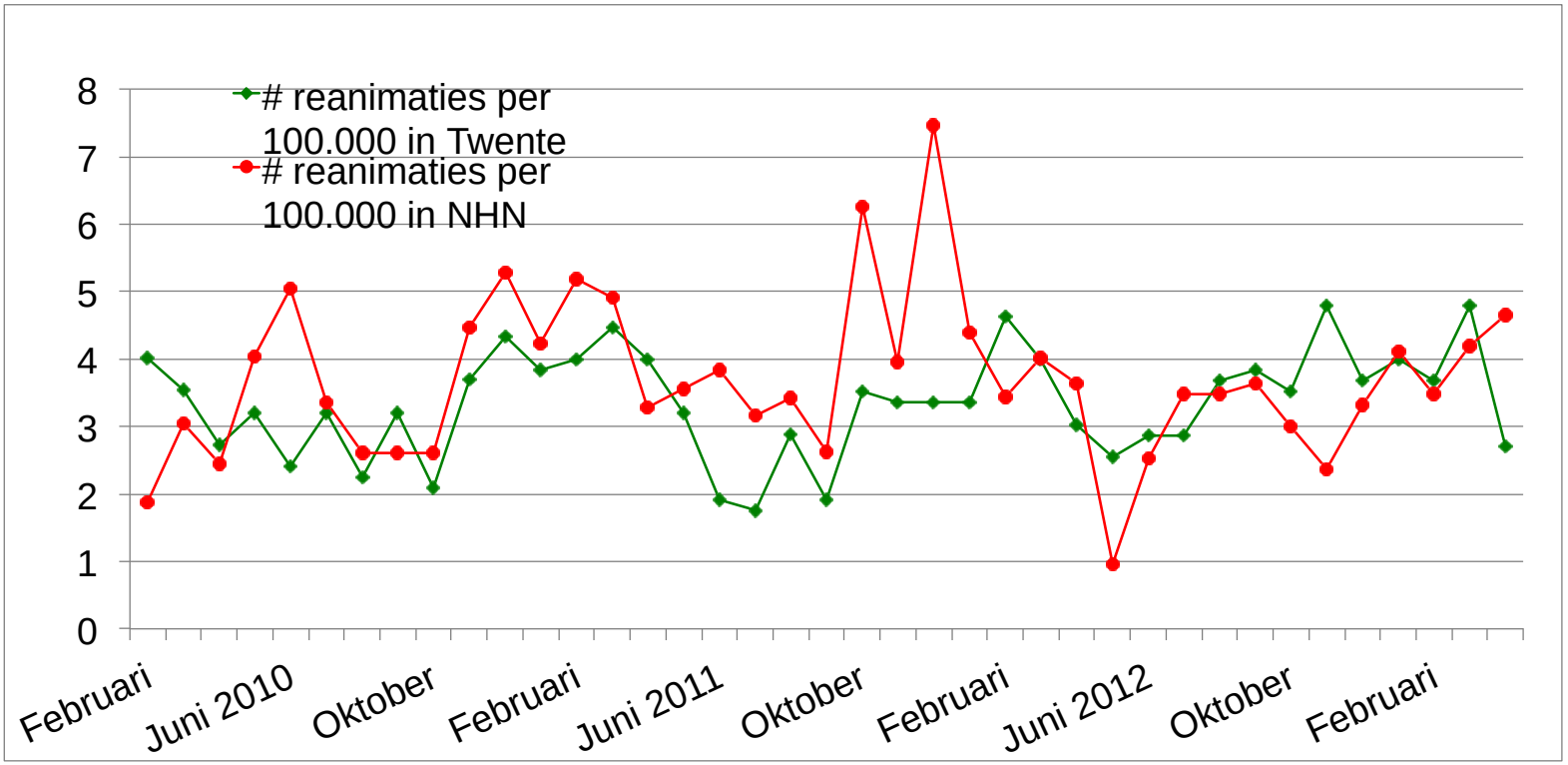
Percentage of population in SMS region



Cumulative number of resuscitations in SMS region

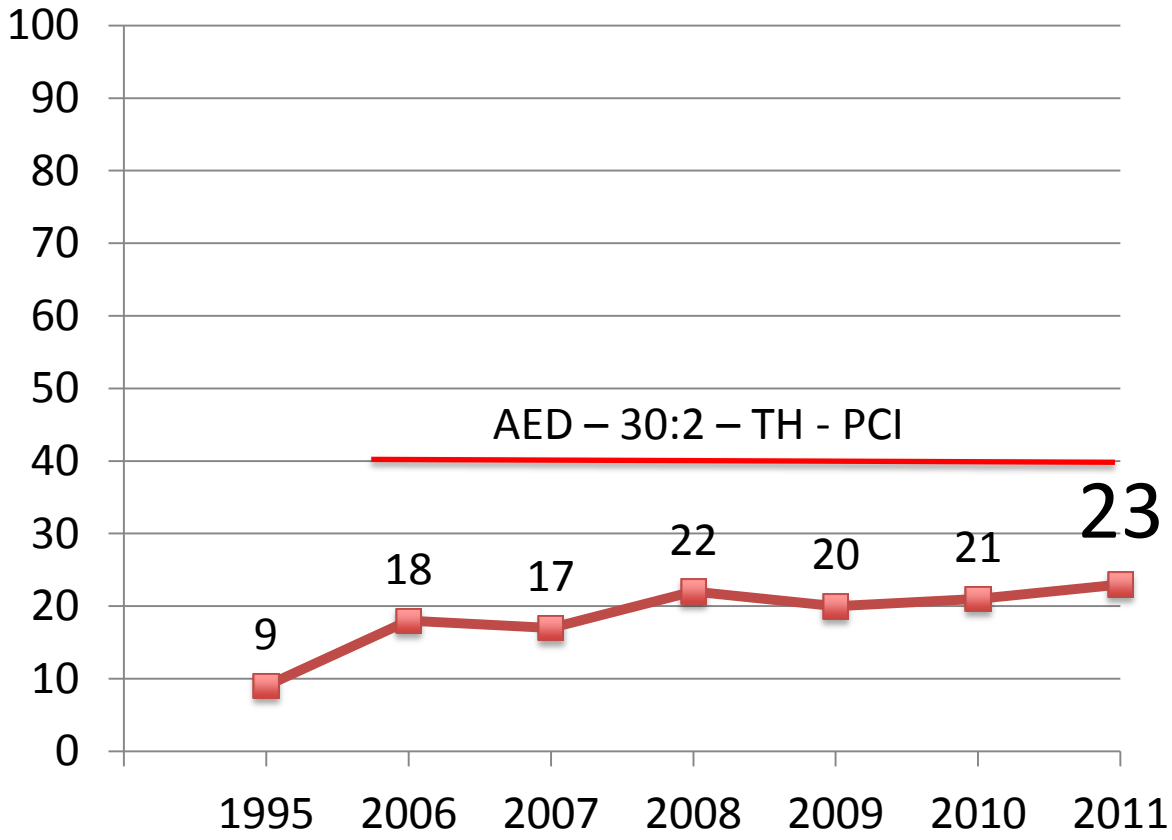


Number of resuscitations/100,000 inh



Survival

witnessed/unwitnessed; all rhythms; bystander BLS/no bystander BLS



2.6 x!

Survival

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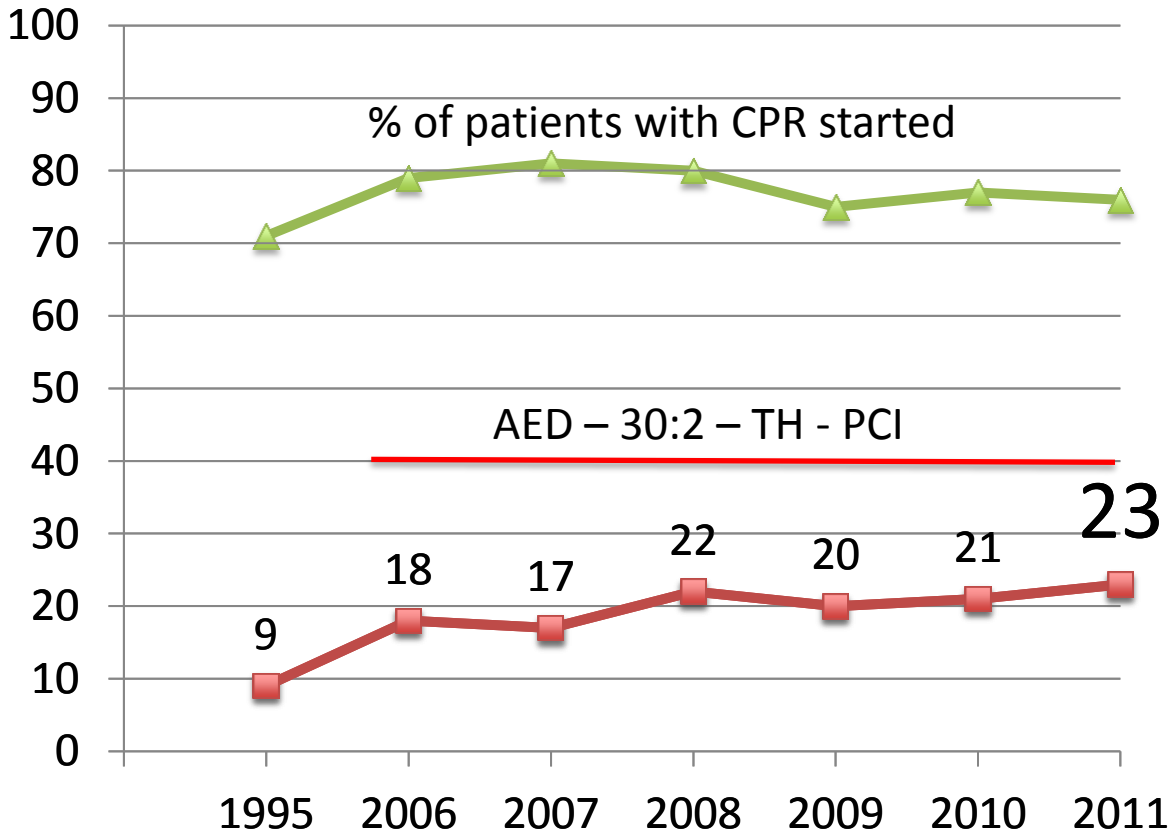

0.5/1000 inh/yr

2.6 x!

Who first connects the AED or defibrillator?

Results 1-2-2010 to 28-4-2013

1730 resuscitations

	ROS area	Total in regions
First rhythm from (n)	1433	1730
Ambulance	700 (48.8%)	864 (49.9%)
First Responders	408 (28.5%)	518 (29.9%)
On site	147 (10.3%)	170 (9.8%)
SMS responder	178 (12.4%)	178 (10.3%)

Delay between 112-call and connection/defibrillation

First rhythm from	N= 711	Delay 112-connect (min:sec)	Delay 112-shock (min:sec)	Time gain from ambulance
Ambulance	300	11:15	11:48	-
First Responders	267	7:42	7:57	4:45
On site	36	4:13	5:01	8:07
SMS responder	54	7:31	8:45	5:32
missing	54			

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